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TWELVE CONSECUTIVE CASE REPORTS FROM THE CONTACT LENS CLINIC

of the

PENNSYLVANIA STATE COLLEGE OF OPTOMETRY*

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On March 15, 1949, the first free contact lens clinic in the United States was opened to the general public by the Pennsylvania State College of Optometry.

The fitting of contact lenses has become an important part of optometric education and is now well established as a specialty within the profession. Because of this growing interest, the College decided to establish a contact lens clinic so that the senior student could receive actual patient experience in addition to his theoretical training.

The clinic, too, is an adjunct to the free eye clinics of the College which have been serving the public for over 30 years.

Since 1945, the College has been offering to the profession a post-graduate course in contact lens fitting, which has been very well received and attended by optometrists from all over the country. The new clinic enables those who participate in its work to receive valuable out-patient experience. It also affords our seniors the opportunity of fitting one another with personal pairs of contact lenses during the course of instruction.

Since we all realize the need of continued extensive research in the field of contact lens practice, I am happy to be able to report that a number of projects are already progressing favorably under the able guidance of the chief of the contact lens clinic, Dr. John C. Neill.

The clinic makes it possible for many members of the general public who are economically unable to pay the fee of a private prac-

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titioner, to obtain contact lenses in cases where the need for such lenses is urgently indicated.

The contact lens clinic is situated in the main building of the College. It can accommodate six patients at one time with three students assigned to each patient. All the necessary instruments are provided here for all types of contact lens fitting.

Through the courtesy of several of the contact lens laboratories, a sufficient number of trial lenses of all types has been made available.

Soon after the announcements of the opening of the clinic, as carried in the public press and on television, requests for admission poured in. Cases to be fitted were selected on the basis of the following considerations:

1. Occupational needs of the patient.
2. Inadequacy of ordinary ophthalmic corrections (as in keratoconus).
3. The presence of disfiguring corneal scars, leucomata, etc., which may lend themselves to cosmetic improvement.
4. The presence of unusually high refractive errors.

Patients who apply for admission to the contact lens clinic are first processed through the general eye clinics and, if found to need contact lenses, are then referred directly to the contact lens clinic. Here, further examination is given and the method of fitting determined. The case is then carried to conclusion by the actual fitting, ordering and adjusting of the lenses in a number of visits. When economic conditions warrant it, the patient is asked to cover the laboratory costs of the lenses. Otherwise, on recommendation of the social service department of the College, the lenses are supplied at no cost to the patient.

Below are described the first 12 consecutive cases taken from among the first 50 applicants to the clinic:

1. L. B., male, age 37, cold storage warehouse jobber.

He has always had difficulty with his regular ophthalmic lenses because of "steaming," as he is continually going in and out of refrigerated rooms during all his working hours. The patient's visual acuity uncorrected was O.D. 20/200 O.S. 20/65. He was wearing the following spectacle correction: O.D. +6.50 D. sph. ⌒ —2.25 D. cyl. axis 45 V.A. 20/65. O. S. + 6.50 D. sph. ⌒ —2.25 D. cyl. axis 135 V.A. 20/20-4.

The case presented no pathology or abnormalities and was fitted with tangent cone contact lenses which gave V.A. O.D. 20/40, O.S. 20/20. The lenses were adjusted with a pair of contact lens pliers to relieve tightness in the superior nasal regions O.U.

The patient wore his contact lenses for three to four hour periods with the development of halos, but no haze. It was suggested to the patient that he remove his lenses every two to two and one-half hours and renew the solution. He now reports constant use of the lenses in this manner with no halo development and, much to his delight, no "steaming."

2. T. P., male, age 39, employed in bottling plant.

This patient presented a dense leucoma on the cornea of the left eye, caused by an accident in 1943. Both eyes were burned, but the right eye presented no pathology, although the cornea showed some irregularity. The patient was desirous of having a contact lens fitted to improve his cosmetic appearance. The leucoma covered the whole cornea of the left eye and was most dense inferior nasally. Rotations were fair. The visual acuity O.D. with —1.00 D. cyl. axis 50 was 20/20+. The visual acuity O.S. was light perception. A tangent cone lens was used in fitting, with a maximum amount of corneal clearance allowed to prevent any pressure on the leucomatic mass. The pupil, as measured under ordinary illumination, was 6 mm. in diameter the iris 11 mm. in width. The iris color was matched from the Naturform Eyecolor chart. The finished lens was adjusted with pliers to stop rotation and scleral pressure. At first, of course, the palpebral aperture was larger with the lens in place. However, after a time and upon dismissal of the patient, the two palpebral apertures were almost identical and the patient's appearance was greatly improved. This case has been reported in the literature.*

3. G. R., female, age 24, housewife. Visual acuity, uncorrected, O.U. 20/200. The patient was wearing the following spectacle correction. O.D. —2.00 D. sph. V.A. 20/30-2. O.S. —3.00 D. sph. ⊃ + 0.50 D. cyl. axis 180. V.A. 20/30-2. A refraction disclosed the need for O.D. —3.25 D. sph. ⊃ —0.25 D. cyl. axis 90. V.A. 20/30. O.S. —3.25 D sph. ⊃ —0.50 D. cyl. axis 90. V.A. 20/30.

The case presented a simple compound myopic astigmatism with no pathology or abnormality. Tangent cone lenses were used in fitting. The final result showed: V.A. O.D. 20/30+3 O.S. 20/30+3 O.U. 20/20, comfortable wearing time four to six hours. (This was still improving.) The phorias at near and distance presented normal findings with an improvement in stereopsis being noted.

4. R. McC., male, age 54, unemployed textile worker. Visual acuity, uncorrected, O.D. fingers at 5′, O.S. fingers at 2′. Iridectomy

*John Collins Neill. The Cosmetic Contact Lens—A Case Report. Am. J. Optom. & Arch. Am. Acad. Optom. 27.7. pp. 329-332. 1950.

O.U. in 1944 and 1945. The patient previously had had keratitis with diminishing vision. He also had photophobia with some diplopia at distance. A central corneal opacification covered the entire pupillary area O.U. There were no evident fundus changes. There was no improvement with an ophthalmic correction. Tangent cone lenses were fitted but there was no improvement in visual acuity. The patient was then referred back to the clinic for subnormal vision examination and possible correction with telescopic spectacles.

5. M. P., male, age 19, student. Visual acuity, uncorrected, O.U. fingers at 6′. The patient was wearing spectacle correction, O.D. —7.25 D. sph. ⌒ —0.25 D. cyl. axis 100, V.A. 20/20. O.S. —7.75 D. sph. ⌒ 0.25 D. cyl. axis 180, V.A. 20/20. V.A. O.U. 20/16.

This patient has been wearing an ophthalmic correction since he was five years of age. Diagnosis of examining physician: Progressive myopia, now halted. This case presented no pathology or abnormalities and was fitted with tangent cone lenses. Upon dismissal, the patient reported seven to eight hour wearing periods, twice daily. An interesting sidelight on this case is the fact that the youth became involved in a fight and received a severe blow in the right eye while wearing his contact lenses. With the exception of a severe scleral injection and subconjunctival hemorrhages, there was no damage to the cornea. The eye was examined carefully under the slit lamp for several days after the accident with negative results. The patient is now in the U. S. Air Corps ground forces, and doing well. Examination showed that all phorias were normal with lenses in place.

6. L. K., male, age 44, blacksmith and rodeo rider. This patient wears a prosthesis on his right eye as a result of a shooting accident when a child. His present correction is O.S. + 4.50 D. sph. ⌒ —8.50 D. cyl. axis 45, V.A. 20/20.

The case report from the clinic stated the following: "This patient rides broncos and bulls at rodeos all over the country. It is impossible for him to wear an ophthalmic correction when doing this. He thinks contact lenses would aid his vision and make it much safer for him to do this type of work."

Our examination showed O.D. prosthesis, O.S. corneal opacity on nasal side, some encroachment on pupillary area. No pathology. Pupillary reaction good, rotation good. The palpebral aperture was short horizontally and very narrow vertically. The lower lid depth was very short and the eye enophthalmic. This patient was fitted with a tangent cone lens, the smallest size available. During fitting it was necessary to grind off considerable material making the lens the smallest

I have ever seen. This proved to be a most difficult case to fit, but after adjusting with pliers, grinding, again adjusting and again grinding off, we succeeded in providing a comfortable fit. The visual acuity was 20/20 and the patient was satisfied.

7. G.D'A., male, age 41, dental technician. This case presented a high antimetropia. He was wearing the following spectacle correction. O.D. —8.00 D. sph. V.A. O.D. 20/200. O.S. +2.00 D. sph. ⌒ —3.00 D. cyl. axis 180. V.A. O.S. 20/30—1. V.A. O.U. 20/30—1. A refraction disclosed the need for O.D. —10.00 D. sph. ⌒ —1.00 D. cyl. axis 15. V.A. O.D. 20/50. O.S. +2.00 D. sph. ⌒ —3.00 D. cyl. axis 180. V.A. O.S. 20/25—2. V.A. O.U. 20/25—2.

The patient complained of diplopia in the evening, headaches, nyctalopia, aching eyes and quivering of the lids. He also complained of aberrations with his present correction. Certain types of work were impossible because of suppression of the right eye and lack of stereopsis and fusion. With a new correction, simultaneous vision was possible, but with very poor fusion. This patient was fitted with tangent cone lenses with visual acuity O.D. 20/30, O.S. 20/20+3, O.U. 20/20. No diplopia was present and fusion was fair. This patient was urged to return for orthoptic exercises to improve fusion; however, he was so pleased with the results that he said they could not possibly be improved. The latest report shows that he is able to do specialized work again, and that his headaches and symptoms of extreme fatigue in the evening have practically disappeared. The wearing time of his contact lenses is four to six hours.

8. V.S., female, age 32, housewife. The patient was wearing the following spectacle correction. O.D. —4.00 D. sph. ⌒ —0.50 D. cyl. axis 180. V.A. O.D. 20/25—2. O.S. —4.50 D. sph. ⌒ —0.50 D. cyl. axis 180. V.A. O.S. 20/25—1. V.A. O.U. 20/20—3. A refraction disclosed the need for O.D. —3.25 D. sph. ⌒ —1.00 D. cyl. axis 180. V.A. O.D. 20/20. O.S. —4.25 D. sph. ⌒ —1.00 D. cyl. axis 180. V.A. O.S. 20/20. V.A. O.U. 20/15.

This was a typical myopic astigmat. She disliked her ophthalmic correction and her small child caused a constant breakage of lenses. The patient showed no apparent pathology nor abnormality. She was fitted with tangent cone lenses. Her visual acuity with lenses was O.D. 20/15, O.S. 20/15, O.U. 20/15.

Stereopsis and fusion were excellent with normal phorias. The wearing time of her contact lenses at the last report was three and one-half to five hours.

9. J.G., male, age 55, former teacher of manual training. The

patient's right eye was removed at age of seven after an accident. Sympathetic ophthalmia occurred infecting and damaging the left eye. Iridectomy performed in 1942. Visual acuity O.D. none (prosthesis), O.S. fingers at four feet. At near the left eye reads J4 type at one inch with 40 D. jeweler's loop. The cornea of the left eye was covered with dense scars, inferior irideremia with slight reflex to light. The pathological department of the clinic suggested we try a contact lens. A tangent cone lens was fitted, but no improvement was noted and we had to dismiss the patient.

10. A.R., female, age 27, stenographer. This patient had had keratoconus for some years. In 1944 she was fitted by a lay concern with molded lenses. The right lens was changed in 1946 to meet a change in the degree of keratoconus. The patient had to wear an ophthalmic correction in conjunction with her contact lenses for best results. She found it necessary to change the solution several times a day, because of the formation of particles in the water lens. Her visual acuity was O.D., O.S. and O.U., 20/60. There were no abnormalities nor pathology other than the keratoconus. The patient was fitted with tangent cone lenses with a corneal radius of 7.5. There was a slight apical touch on the left eye. The right lens cleared nicely. The visual acuity improved to O.D. 20/25—2, O.S. 20/25—2, O.U. 20/25+2. The patient found it unnecessary to use an auxiliary correction with these lenses. Her wearing time increased to eight hours, plus, and no particles formed in the water lens. A set of molds was then made up and the laboratory instructed to make the lenses without the customary corneal build up. These lenses, therefore, rested on the apex of each cornea and resulted in an improvement of the V.A. to O.D. 20/20—2, O.S. 20/20, O.U. 20/20. Also, there was such an increase in the wearing time that we had to insist that the patient remove the lenses from the eyes for one hour at noon and again around the dinner hour. No ill effects have been observed from the apex touch. Frequent checks are being made on this case to determine what, if any, effects the apex touch will have as time goes on. This case presented a challenge which we feel has been met with success.

11. M.S., male, age 35, housing inspector. The patient's present correction was O.D. —6.50 D. sph. ⌒ —1.00 D. cyl. axis 180. V.A. O.D. 20/16. O.S. —7.00 D. sph. ⌒ —1.12 D. cyl. axis 180. V.A. O.S. 20/20. V.A. O.U. 20/20—.

This patient feels insecure without his correction and yet he does not like to wear ophthalmic lenses. He enjoys sports but cannot participate in them because of his high myopia. This case presented no ab-

normalities or pathology and was fitted with tangent cone lenses. The final visual acuity was O.D., O.S. and O.U. 20/15. Fusion and stereopsis were good with all phoria tests normal. The wearing time at last report was about five hours.

12. V.L., male, age 39, student. The patient's present correction was O.D. —3.75 D. sph. O.S. —3.00 D. sph. V.A., O.D., O.S., and O.U. 20/20.

This patient is Chinese and presents the ocular characteristics of his race. The palpebral apertures are long horizontally and medium vertically, the lower lid depth is shallow and the eyes are exophthalmic. Tangent cone lenses were first tried with fair fitting success, but it was decided to fit this patient with molded lenses for best results. The visual acuity with contact lenses was O.D., O.S. and O.U., 20/20: with good fusion and stereopsis and normal phorias.

CONCLUSION

Thus far the clinic has cared for a number of people who would otherwise never have been fitted with contact lenses. In several cases, patients are now enjoying the best vision of their lives, while in others, patients are able to do their daily work with greater skill, accuracy and safety. Self confidence has been restored to a number of patients by an improvement in their appearance, cosmetically, by the covering of unsightly ocular scars. Ophthalmic corrections have been discarded by some in favor of their new contact lens corrections. Undergraduate students have had the privilege of observing and fitting actual cases. This experience has added to their knowledge and understanding of the specialty of fitting contact lenses. The contact lens clinic is fulfilling its mission in providing another step in optometric education and in service to the public.

DISTURBANCES OF VISION IN MENTAL DISEASE*

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When I set out to prepare notes for a dinner meeting of the District of Columbia Society of Optometry, I looked up optometry in the Encyclopedia Brittanica, and came across this lucid little gem:

> "According to the Abbe Sine Law, in a system symmetrical about an axis, if there be no aberration in the image of a given point on the axis, then the absence of aberration in the image of a small object normal to the axis through this point, is obtained by considering displacement normal to the axis. If phi and phi prime are the angles made by an incident and the corresponding emergent ray with the axis, this can be expressed as mu phi sine equals mu phi sine prime plus a constant."

After I had read this several times I finally became very grateful for whatever influences led me into the study of psychiatry rather than optometry.

However, before we delve into our subject, permit me to remark that neuropsychiatrists devote considerable time to the examination of the eyes, and, therefore, have much in common with optometrists.

It is said that the clinicians of an older time had uncanny ability in "eye" diagnosis. By puffiness of lids, kidney disease was suspected; by the jaundice of the sclera, liver disease was found. The irregular, fixed pupils betrayed the syphilitic, the bulging eyes indicated toxic goiter. It is even claimed that Sir William Osler, the great English physician, once made teaching rounds with the sheets drawn up to the patient's neck in an ostentatious demonstration of the value of "inspection" in physical diagnosis. He paused at the foot of a bed where a young man lay sick. The great doctor studied the patient's face and eyes carefully and then confidently made the correct diagnosis—undescended left testicle!

This absurd story is no doubt manufactured as a reaction against the extreme claims which some medical men have made about the diagnostic value of the eyes. I recall once seeing a book entitled "Iridiagnosis," which proposed to diagnose every disease known to man by inspections, measurements, and functional testing of the iris. On the other hand, certain of our teachers in medical school had considerable rustic contempt for medical ophthalmology. Old Professor Moenkhaus, in our freshman year at the medical school at Indiana University, used to lecture rather cynically on the physiology of the eye. After explaining the human camera with the usual diagrams of the inverted candle on

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the retina he concluded by removing his spectacles and saying, "When I was a young man (he was then nearing 70) I went to an ophthalmologist when my vision grew blurred and dim. The doctor would put drugs in my eyes that made me blind and dizzy. He would shine a light in my eyes and give me a prescription which was expensive and troublesome to fill. Now I go to a country store and rummage through a pile of assorted spectacles until I find some lenses which are comfortable and through which I can see. They cost me 50 cents."

Of course, old Professor Moenkhaus knew that he did not have glaucoma or any compound astigmatism and that his simple presbyopia required only simple lenses.

Somewhere between the extremes of "iridiagnosis" and fifty-cent spectacles, you will find the attitude of most practicing physicians and neuropsychiatrists today.

Aside from the fact that the pupillary reflex is our most sensitive and available criterion for the depth of coma in an unconscious patient and a great help in many conditions due to drugs, the eyes are of extreme diagnostic importance in a variety of neuropsychiatric conditions. A careful ocular examination is of utmost importance. Like Sir William Osler, the neuropsychiatrist often makes his diagnosis by what he finds in his examination of the eyes. We might appropriately paraphrase the poet who said that the eyes were the "windows of the soul," by saying instead that the eyes are the "windows of the brain."

The nystagmus of disturbed cerebellar or vestibular functions: the unblinking, reptilian stare of certain midbrain disease, the light-fixed, unequal, pupils of syphilis, the sunken eye and miosis of Horner's syndrome and the paralysis of the oculomotor, trochlear or abducent muscle function are all helpful in locating a disease process in the nervous system exactly. The study of the optic fundus and of the visual fields are of utmost importance to the diagnosis of tumor and other structural disease of the brain substance. Indeed, out of the total of 12 cranial nerves, at least six are routinely tested, either directly or by reflex arcs by an examination of the eyes alone. It is a small wonder then that vision and ocular function are of such importance to the neuropsychiatrist.

Let us direct our attention to those distortions and aberrations of vision that are not due to the lens or iris, nor to the muscle and nerves. Let us consider eye symptoms that do not arise from disease of the eye at all.

In a great many instances the mentally sick patient will consult first with an optometrist when a visual complaint arises. Some understanding of psychiatry, therefore, is required so that the patient may be

guided wisely and so that mistakes will not occur nor time be wasted by either the patient or the examiner.

The mental disorders that are encountered fall roughly into two groups: the neuroses and the psychoses. The former are relatively mild, not requiring hospitalization, whereas the latter may require institutional care because of their tendency to render the patient dangerous to himself or others.

Both of these types of "mental" disease may cause the patient to be unduly concerned with his eyes. The average normal man manages somehow to get along with any eye difficulty he may have (even total blindness). He will get glasses or medicine or have an operation and be satisfied with it; make physiological and psychological adjustments and go about his business. On the other hand, certain people with perfectly good eyes, or reasonably good eyes, will magnify trivial visual disturbances into great problems, forgetting all else as they run from one eye specialist to another.

This tendency to show undue concern over trivial visual defects should lead one to suspect a psychoneurotic. Rather than fit such a person with another pair of spectacles with a change of one-half or even one diopter, it is far better to face the problem squarely and to tell the patient that you do not believe his eyes are entirely at fault. You will not have a satisfied patient no matter what you prescribe. He will go to another optometrist eventually.

If, however, the patient complains of his eyes in a peculiar way or a bizarre fashion—by saying, for example, that they feel as if they were being "burned out" or "twisted in their sockets," you may well have a patient with a psychosis or major mental disease. I will later furnish some examples of this type of patient, but first allow me to introduce this subject properly.

We have an example in our English language of the significance of the eyes to express mental states in normal persons. For example: "To have one's eyes open," means to be acute or clever. The expression "do you see?" means to understand. "To look after" means to care for. "To overlook" means to forget. "To disregard" also means to forget. "To oversee" means to manage. If one says "I will see about it," they mean "I will find out." If they say, "I will see it through," they mean "I will accomplish." If they say "I can see through it," they mean they are not deceived. To "take a dim view" is to doubt. In other words, vision seems to be the most important of our senses. This is possibly because of the primacy of vision in the development of communication and hence of intelligence.

The eyes occupy a prominent place in the folklore of every race and in the thinking of every individual. It is understandable, therefore, that mentally sick patients frequently show unusual and undue concern with eye structures. One of our most striking and universally held traditions is that a weak or inadequate person is unable to look a stronger man in the eye. Nearly everyone believes that some sort of influence is exerted by this organ. It is not remarkable, then, that in schizophrenia, this belief is frequently extended to the irrational idea that people are watching, peeping, spying or that others are influencing their minds in some mysterious fashion.

The belief that certain persons can injure or even kill with a glance, has been, and is still, very widespread. In the last war I found myself in Africa and Italy where I encountered evidence of this belief frequently. In Africa, the Arab vans carried symbols to ward off the evil eye. A favorite necklace was a delicate silver filigree of a female hand—the hand of Fatima (daughter of Mohamet). Sometimes the power of the evil eye was supposed to be involuntary. The Bible contains frequent reference to this. For example in Deuteronomy 28:54:

> "So that the man who is tender among you, and very delicate, his eye shall be evil toward his brother, and toward the wife of his bosom, and toward the remnant of his children which he shall leave."

Lewistein tells the story of a Slav who, afflicted with the evil eye, blinded himself in order that he might not be the means of injuring his children (Woyeiki, Polish Folklore). In Rome we are told that the "evil eye" was well recognized and special laws were enacted against injury to crops by incantation, excantation or "fascinatio" (from which we derive our verb "fascinate"). Children and young animals of all kinds were thought to be especially susceptible. Charms were worn against the evil eye both by man and beast. They were of three classes: (1) those intended to attract the malignant glance onto themselves; (2) charms hidden in the bosom of the dress, such as the hand of Fatima on a necklace; and (3) written words from sacred writings. Of these three types the first—the obscene object—was most numerous. In Naples and Pompeii during the war many soldiers purchased souvenirs of bronze figures representing a phallus with wings like a bird. Other forms were of frogs and beetles. These things were used as talismans.

Spitting among the ancient Greeks and Romans was the most common antidote to the poison of the evil eye. Those of us in the Mediterranean can surely recall how the street urchins of Casablanca, Cairo, and Bizerte, spat at us as we passed. Gestures, often intentionally obscene, were apparently regarded as prophylactics on meeting the dreaded individual. In Naples the "jettatore" (or eye thrower) was greatly feared.

As foreign soldiers we were often considered evil and therefore, possessors of the power of the evil eye. Our approach would clear the street of children. The small ones who peeped at us were snatched up by their mothers who would kiss the child's eyes and then spit at us, holding their fingers out to us in a gesture to resemble a fork.

We, who consider ourselves free of such primitive beliefs, nevertheless feel uncomfortable when people stare at us. We make laws against "peeping Toms." Popular tradition holds that a snake can charm a bird into its mouth with its eyes, or that a man can "stare down" a beast such as a dog or even a lion. It is considered a contest of mental and moral strength to see who can maintain a fixed look into another's eyes the longest without averting the gaze. How many of you have heard the familiar expression, "If looks could kill, I would certainly be dead"? indicating a half belief in the destructive force of the gaze. Hypnotism is popularly supposed to be accomplished somewhat in this fashion (although in actual practice, it is done more with the voice when the subject's eyes are usually closed). We recall the rhyme of the Ancient Mariner, "He held me with his glittering eye—I could not choose but hear." And how John Barrymore played Rasputin and how Svengali influenced Trilby from offstage in Maurier's novel? Does not Mandrake, the magician, every day in the comic pages perform miracles of influence with hypnotic gaze? And what about "Evil-Eye-Fleagle" of the Little Abner strip: a real hypnotist capable of measuring the strength of his ocular power into quarter whammys, half-whammys and even the double-whammy (which he has never dared to loose because it might cause atomic distintegration). I remind you of these things to embroider my theme: that the eyes are still popularly believed to exert a mysterious and powerful influence in folklore and in primitive custom as well as in the minds of children or superstitious adults.

Now back to our subject. One theory has it that certain patients with mental disorders manifest symptoms that indicate the primitive concept of the evil eye lies dormant in our subconscious mind until released by mental disease. Allow me to give some examples to illustrate this.

A young man was admitted to the hospital with tightly closed eyes. His parents brought him in because they felt he had developed some physical disorder affecting the eyelids. He kept his eyes shut most of the time, opening them only a little to see when he ate. Myasthenia, a neuromuscular disease was considered. A complete examination showed nothing wrong with the muscles of his eyelids. He later admitted to us that he was holding his eyes closed because he felt that if he opened

them he would "destroy the world." Still another patient was brought into the hospital because of an eye injury. During his wife's pregnancy, he had felt very guilty for having caused his wife to "be in that condition" and had brooded about the matter. Finally he deliberately blinded one eye by running a nail into it. This seems to be related to the Slav peasant and to Deuteronomy 23—the fear that his eye might injure the newborn.

Another patient was brought in only recently, wearing dark glasses. When questioned why he wore these dark glasses, he explained it was because his wife told him he had a "crazy look in his eyes." He was very self-conscious about the appearance of his face and acted tremendously uncomfortable every time we asked him to remove his dark glasses. The patient in this instance did not admit that his eyes exerted a bad influence on others, but inquiry revealed marked conscious fears. He was afraid that the expression in his eyes might betray his "crazy ideas." Does this not seem somehow related to the evil eye?

A final example is given of a female patient, who had recurrent attacks of blindness. She could not account for these attacks coming on nor for their spontaneous disappearance. Under the influence of our study we were finally able to determine that in her early childhood she had witnessed an unpleasant scene between her father and her mother, and as a result of this whenever this memory came to her conscious mind she literally "blinded herself" in order not to see such a sight again.

This latter mechanism is known as hysteria. Such patients seem to be obeying the Old Testament admonition, "If the eye offend thee, pluck it out." It is probably the explanation of the stories in the newspapers where you frequently read that a person who has been blind for years suddenly recovers his sight, at least of those cases which recover their complete sight suddenly after a stirring religious or emotional experience. Though not related to the evil eye motif, at least it exemplifies how mental patients use their eyes in symbolism.

Greenacre, in analyzing the mental patients with eye symptomatology, divided them into three groups: those in which the eye had changed color, form or outward appearance, and this change seemed apparent to others. Secondly, those patients who believed in a change or diminution of their own vision, either as a punishment for sexual looking or as a symbolic castration, and thirdly, those patients who believe that their own eyes transmitted or received evil influence, (the evil eye).

Psychosomatic disease is a third type of mental disease you may encounter other than psychoses and neuroses in which the eye may be

affected. Several years ago, W. S. Inman reported in "The British Journal of Medical Psychology" that glaucoma, unequal pupils, watering of the eyes and squints were frequently associated with emotional distress (particularly of a sexual nature) in his patients. He found the relation between stammering, left-handedness and cerebral dominance also to be a factor in some of his cases. He recited many cases where a prospective father suffered from styes and squints. He was struck by the coincidental relation of the eye infections in men to the pregnancy of their wives. He told of a case of illegitimate pregnancy. An unmarried man with styes revealed that his styes appeared a few days after he received a letter from his girl friend stating she was pregnant.

A temporary mental aberration often results from delirium when the brain is fevered, during which false visual perceptions are encountered. Hallucinations, which are false visual perceptions, have an internal rather than an external stimulus. The stimulus is presumed to arise in subconscious mechanisms and be motivated by memories or symbols in the "subconscious mind," though activated by shadows and illusions actually in the environment.

These phenomena occur characteristically in delirium tremens and are often, in the beginning, misidentifications and misinterpretations of objects dimly perceived by a clouded consciousness. Thus, a shadow becomes a spider or a bedsheet a ghost. In delirium tremens due to alcohol, the "pink elephant" of familiar jest is less frequently encountered than the more terrifying snake (described so well in "Huckleberry Finn.")

It is true that animals are favorite subjects — chickens, snakes, spiders, birds and monkeys (and occasionally elephants). They are usually of diminutive character and are perceived as "little" men, "little monkeys," etc. This micropsia, or lilliputian vision, is sometimes observed in other than toxic disease: (namely, in some tumors of the brain.)

I am sure that if any patient came to you to get spectacles because he was seeing pink elephants you would not attempt to fit him with glasses. I am equally sure, however, that each of you will see frequently in your offices many cases whose ocular symptoms and complaints do not arise from diseases or refractive problems of the eyes.

There are a lot of "angles" to optometry that the Abbe Sine Law does not explain. We must conclude that mu phi sine plus a constant leaves much to be explained.

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THE ZONE OF CLEAR SINGLE VISION AT THE UPPER LEVELS OF ACCOMMODATION AND CONVERGENCE*

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INTRODUCTION

At the present time the theory as to how the eye increases its refractive power in viewing near objects is fairly well established. It seems reasonably certain that such changes in refraction are effected primarily by variation in the form of the lens of the eye which is produced by contraction of the various fibers of the ciliary muscle. The work of Fincham[7] seems to indicate that the changes produced in the lens are mediated by the elastic force of the lens capsule which is modified when the tension on the fibers of the Zonule of Zinn is relaxed by contraction of the ciliary muscle.

However, certain problems remain to be solved concerning the changes in the ability of the eye to accommodate which occur with age.

As the normal person grows older, his ability to accommodate is gradually diminished. To explain this, Gullstrand[14], Hess[15, 16], Fuchs[11,12], Flieringa and van der Hoeve[8, 17], and others have supported the following theory:

(a) There occurs with age a decrease in the limit to which the lens can be made to change its form.

(b) Insofar as the lens can be made to change its form, the same amount of ciliary contraction is required, at all ages, to produce a unit change in the form of the lens.

(c) As age increases it is to be expected that there will be an ever increasing excess amount of ciliary contraction beyond the power of the lens to respond to it.

On the other hand, the theory implied in the writings of Donders[2] and Landolt[22] and formulated more completely by Duane[3, 4] and more recently by Fincham[7] holds that the maximum amount of ciliary muscle

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contraction is necessary to produce maximum accommodation at all ages. According to this theory either of the following may occur in old age: (a) a greater amount of ciliary muscle contraction is required to produce a unit change in accommodation than was previously required, or (b) the ability of the ciliary muscle to contract is diminished in some manner.

Hess[15, 16] called attention to the fact that several of Donders' graphs of the zone of clear single binocular vision suggested a maximum convergence at the absolute near point of accommodation far in excess of the maximum convergence attainable at submaximal levels of accommodation. Hess attributed this to accommodative convergence associated with ciliary contraction in excess of that minimum amount required for maximum accommodation.

Unfortunately, Donders' method of determination of the maximum convergence at the absolute near point of accommodation can hardly be considered valid. From Donders'[2] description of the procedure it is evident that the point plotted as the maximum convergence at the absolute near point of accommodation represented not the near point of binocular convergence, but the sum of the maximum amount that each eye could turn nasalward.

Analyses of the zone of clear single binocular vision which have been made subsequently have not investigated in detail the nature of the zone at the higher levels of accommodation and convergence[9, 10, 18, 23, 24, 25], and it has not been possible to test the validity of Hess' hypothesis. Usually, these investigations were carried out on some modification of the mirror haploscope which imposes mechanical limitations on the maximum amount of convergence which may be measured. For example, the apparatus employed by Hofstetter[18] was limited to a maximum convergence of 45°. In those cases in which the maximum convergence was reached within the limits of the instrument, Hofstetter could not find evidence of an extension of the zone beyond the limit predicted by the slope of the zone.

Aside from the shape of the zone of clear single binocular vision at the near points of accommodation and convergence, other evidence has been offered from time to time to establish the validity of one or the other of the two theories previously described. Since this evidence is rather diversified and indirect, a brief review of the work done in this field seems advisable.

In 1914 Lancaster and Williams[21] reported an experiment which lends some support to the theory that the ciliary muscle has an ability to contract which is greater than is required to produce maximum accommodation. In attempting to fatigue accommodation by having

subjects maintain prolonged fixation of print at the absolute near point of accommodation, they found that in their subjects (ranging in age from 28 to 60 years) the absolute near point of accommodation approached the eye during the course of the test. They attributed these results to a slow increase of curvature of the lens due to its viscosity-like character. Such an increase in curvature could most easily occur in an eye in which the ability of the ciliary muscle to contract was greater than that required to maintain the accommodation at the initial near point of accommodation.

In 1922 Fuchs[11] cited the experiments of Treutler who applied a drop of 2% solution of euphthalmine (which produces only a partial paralysis of the ciliary muscle) in the eyes of an 11 year old boy and a 38 year old man. In the former case a reduction in the range of accommodation of 4 diopters was produced by the drug, while in the latter case no recession of the near point of accommodation was effected. On the basis of this experiment, Fuchs concluded that in the older subject only a part of the total ciliary muscle power was required to obtain the maximum amplitude of accommodation, i. e., the drug affected only the latent ciliary muscle contraction range postulated by Hess.

In 1925 Duane[4] measured the length of time which elapsed from the instillation of homatropine until the onset of paralysis (as evidenced by the recession of the near point of accommodation) in 2,013 patients. In general, the onset of paralysis occurred earlier in the older age groups than in the younger age groups, but no attempt was made to establish whether these differences were statistically significant. Duane concluded on the basis of these data that Hess' concept of a "latent ciliary muscle contraction range" was wrong and that the amount of ciliary muscle power necessary to produce a unit change in accommodation increased as the amplitude of accommodation decreased. This method leaves itself open to the criticism that a difference in permeability of the eye to the drugs might have accounted for the age variations which occurred, and perhaps even concealed a variation in the time of onset of paralysis with age in the opposite direction.

In 1924 Flieringa and van der Hoeve[8, 17] reported experiments designed to test Hess' concept of a "latent ciliary muscle contraction range" beyond the limits of the absolute near point of accommodation. They reasoned that if there is a linear relationship between convergence and contraction of the ciliary muscle, there should be a change in the ratio between the two responses when the ciliary muscle is partially paralyzed. According to Hess' notion, this change in the ratio should became manifest during a finite interval of time in which no change in

the physical amplitude of accommodation would be demonstrated. By measuring the change in slope of the line representing the limits of negative relative convergence in two subjects who were recovering from the effects of cycloplegia induced by homatropine they were able to demonstrate the existence of this latent ciliary muscle contraction range. However, recent attempts to repeat the experiments of Flieringa and van der Hoeve on five subjects have so far given data which do not support Hess' interpretations[20].

Recently Goldmann and Aschmann[13] reported an experiment to determine the extent of variation of the amplitude of ciliary muscle contraction with variation in the amplitude of accommodation. This was accomplished by producing a partial paralysis of one eye with homatropine and measuring the amount of accommodation employed by both eyes to fixate objects at various distances. The ratio of the accommodation employed by the partially paralyzed eye to that used by the non-paralyzed eye was found to be constant for various distances of fixation and was taken as the index of paralysis of the ciliary muscle of the eye in which the homatropine was placed. This was found to be less than the ratio of the amplitudes of accommodation of the two eyes. On the basis of these data Goldmann and Aschmann concluded that the maximum limit of ciliary muscle contraction was always greater than the amplitude of accommodation, but not to the degree postulated by Hess.

In an attempt to repeat the experiments of Goldmann and Aschmann using a different method for the determination of the accommodation in play and the near point of accommodation the ratio of accommodation in the two eyes with submaximal effort was found to be the same as the ratio of the measured amplitudes of accommodation[19]. The experiment, however, is not conclusive because there was no way of knowing whether the ciliary contraction was ever more than the minimum required to maintain maximum accommodation in the non-paralyzed eye.

PURPOSE

It was the purpose of this investigation to study the nature of the zone of clear single binocular vision at the levels of maximum accommodation and maximum convergence with specific reference to the implications that the shape of the zone in this region has upon the theories of accommodation.

APPARATUS

Figure 1 is a diagram of the apparatus which was used to measure the accommodation and convergence at the near points. This apparatus

has been called the proximometer. In the diagram, M represents a semi-silvered mirror which was mounted in such a manner as to rotate around a vertical axis through the point c. The amount of rotation of M around this axis could be determined from a pointer on the mirror mount and read from the scale S. The head of the subject was held firmly against the mirror mount so that the point c coincided with the center of rotation of the left eye and so that the extension of the mirror was normal to the line joining c and c′ (the center of rotation of the right eye). The mirror was then moved laterally until its extension bisected the line cc′. The mirror and the head were then free to rotate together around the point c.

The lenses L_1, L_2, and L_4, and the semi-silvered mirror M′ were all mounted in a fixed position on an optical bench and centered on a line which passed through c.

The target T was mounted on a carriage which was free to slide on a track in a fore and aft direction in such a manner that the image of the target formed by the mirror M′ was always centered on the line cs. The position of the target at any moment could be determined from the scale S′.

The lenses L_1 (+3.00 D.) and L_2 (+8.00 D.) were separated by a distance of 63 centimeters. The secondary focal point of this system, for rays transmitted through M, coincided with a point 10 millimeters anterior to the point c, i.e., approximately at the center of the entrance pupil of the left eye. For the rays reflected at M, the secondary focal point coincided with a point 10 millimeters in front of c′. This arrangement represents essentially a Badal optometer system and makes possible the variation in the stimulus to accommodation by variation of the distance of T from L_1 without variation in the size or luminance of the retinal image.

With the eyes in such a position that the extension of the mirror M was the perpendicular bisector of cc′, two images could be seen. The left eye saw an image of the target T by transmission through the semi-silvered mirror M while the right eye saw an image of the target T by reflection at M. These two images formed the stimuli to fusion in the experiment. The amount of convergence was varied by rotation of the mirror and head around the point c and was determined from the scale S which was calibrated in degrees of convergence.

The target T was a photographic reproduction of a series of concentric circles on transparent film and was placed in front of a milk glass which was illuminated from behind. The target is illustrated in Figure 2. The diameter of the first circle subtended an angle of 13 minutes at

the entrance pupil of the eye, that of the second circle, 19 minutes while that of the third circle, 3.5 degrees. The entire field subtended an angle of 7.0 degrees.

The criterion for focus was the ability of the subject to keep the two central circles resolved as two, while the criterion for fusion was the ability of the subject to keep the outer circle single. The stimulus to accommodation was measured by the distance of the target T from the lens L_1, which was obtained from the scale S′ (as shown in Figure 1).

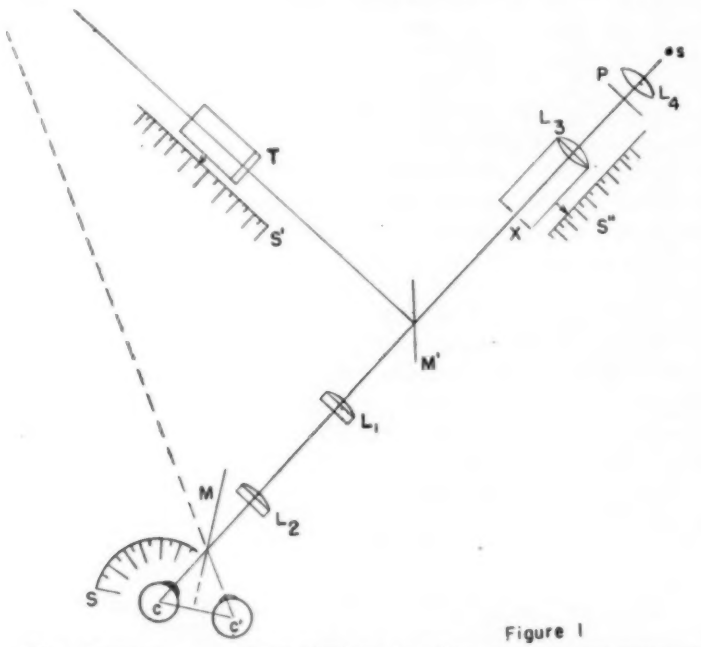


Figure 1

The amount of accommodation in play at any moment was determined on the principle of brightness contrast threshold as described by Reese[26]. A light from a sodium vapor source s was collimated by the lens L_4 and brought to a focus by the condensing lens L_3 in the plane of the slit x. The carriage on which the lens L_3 and the slit x were mounted was free to move in a fore and aft direction along the line cs. This carriage was attached by a chain drive to a crank which made it possible for the subject to vary the position of the slit by turning the crank. The position of the slit at any moment could be obtained from the scale S″.

PROCEDURE

In order to determine the nature of the zone of clear single binocular vision at the near distance, the amount of accommodation in play was determined for various values of convergence, the stimulus to accommodation remaining fixed. The position of the target T was fixed at a given stimulus value. The mirror M was then set at the minimum convergence value (30 degrees), and the subject converged his eyes the amount necessary to fuse the two images of the target T. The position of the slit was changed to the distance estimated to give its maximum visibility. The slit was then made just visible first by reducing its width and secondly by reducing the intensity of the light on the slit by means of a pair of crossed polaroids P (Figure 1). The mirror M reflected more light than it transmitted so that in the region of the threshold of visibility the slit was seen only by the right eye. Hence the right eye was always used to make the measurements of the amount of accommodation in play.

To measure the amount of accommodation in play, the subject moved the slit forward until it disappeared and backwards until it became just visible. He next moved the slit backwards until it disappeared and forward until it was just visible again. Three determinations of the most forward "just visible point" and three determinations of the farthest "just visible point" were made in this manner, and the average of these six readings was taken as the amount of accommodation in play. The mirror and the head were then rotated to increase the convergence. The amount of accommodation in play for a given stimulus to accommodation was determined in this manner for values of conver-

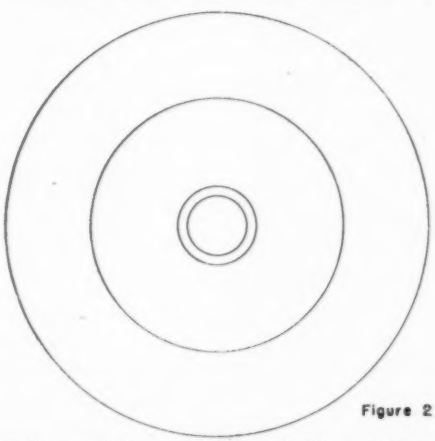


Figure 2

gence in 5 degree intervals out to the maximum value of convergence.

The position of the target T was then varied so that similar measurements were made at higher stimulus levels of accommodation.

At high degrees of convergence the subject was permitted to allow his eyes to dissociate and to fuse the targets intermittently. The adjustments of the accommodation measuring device were made during the brief interval of time that fusion was maintained, even if the adjustment required several periods of alternating dissociation and fusion.

The procedure followed in making the test was to start with T at or near the relative far point value of accommodation at 30 degrees of convergence and increase the stimulus value in two diopter steps until the maximum level of accommodation was reached or exceeded.

It should be pointed out that the near point of convergence as obtained in this experiment might logically be expected to be less than the finding obtained by ordinary push-up methods. This is true for two reasons: (a) the time involved in making the accommodation measurement was such that although the subject might be able to fuse the targets at high convergence values he would be unable to maintain this fusion long enough to make the required measurements of accommodation: (b) the experimental design was such that it did not afford the subject the opportunity of employing the maximum amount of proximal convergence that might be available to him.

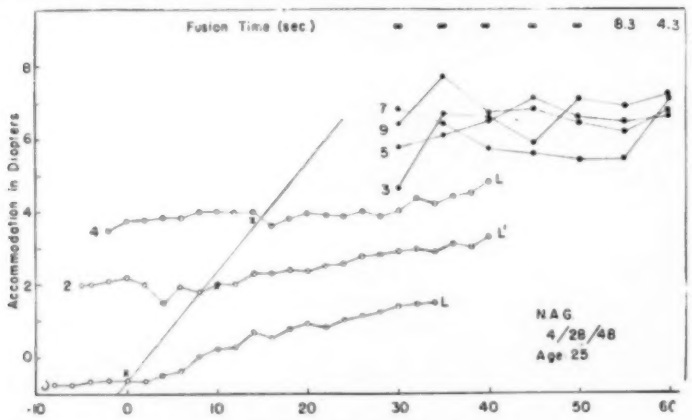


Figure 3A, Convergence in Degrees

In order to determine the nature of the zone of clear single binocular vision at values of convergence less than the minimum afforded by the apparatus described (i.e., 30 degrees), measurements were made on

the mirror haploscope described by Hofstetter[18]. The procedure followed was to measure the amount of accommodation in play for various values of convergence at a fixed stimulus to accommodation.

An important difference existed between the measurements as determined with the haploscope and the measurements made on the proximometer. In the latter situation, the convergence stimulus was fixed at a definite value and the subject was then instructed to fuse the images: the same process being repeated at higher convergence values until single binocular vision was no longer possible. In the haploscope determinations, the stimulus to convergence was slowly and gradually increased from a minimum value to the maximum possible convergence obtainable.

RESULTS

The results for 13 subjects are reproduced in Figures 3 to 15. In these graphs the amount of accommodation in play is represented along the ordinate, and the convergence employed to fuse the test object is plotted along the abscissa. The points plotted as open circles are points

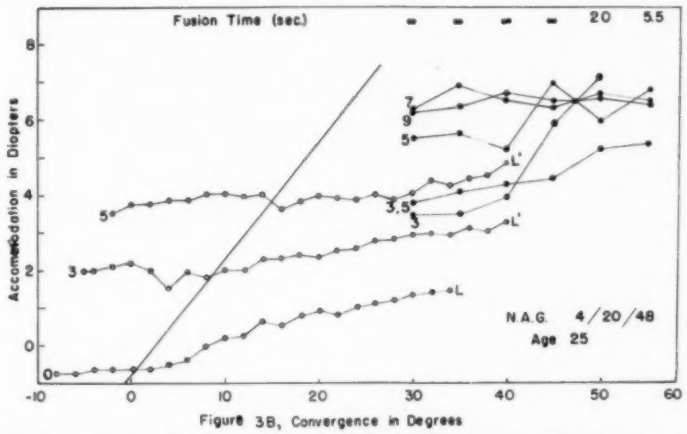


Figure 3B, Convergence in Degrees

which were determined on the haploscope, and the points plotted as solid circles were determined on the proximometer. The crosses are phoria position at different accommodation levels as determined on the haploscope. A line, determined by inspection to represent the best fit of the phoria positions has been drawn in each figure. This may be referred to as the phoria line. The points marked by L represent measurements at the limit of the accommodative measure of the haploscope, while the points marked by L′ represent measurements at the convergence limit of the haploscope.

The haploscopic determinations are in general accord with similar

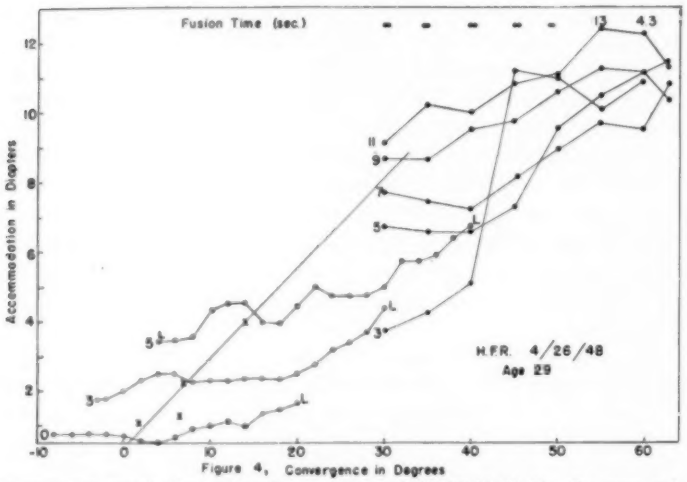


Figure 4, Convergence in Degrees

measurement made by other investigators[9, 10, 18, 23, 24, 25]. In general the haploscopic curve for the amount of accommodation in play at various values of convergence, with a fixed stimulus to accommodation, may be represented by an ogive form which is parallel to the abscissa in the region of the phoria and becomes parallel to the phoria line at the extremities.

The general trend of the data of the 12 subjects obtained on the proximometer may be described as follows:

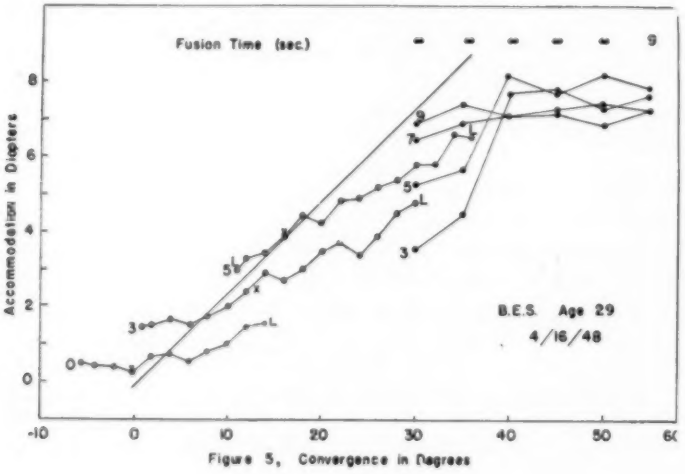


Figure 5, Convergence in Degrees

For the lower stimulus levels of accommodation there is a general tendency for the curve to rise sharply at the lower convergence values and then become tangent to a line parallel to the abscissa at the higher convergence values. This is best illustrated by Figures 4, 5, 8, and 10.

The curves at higher stimulus levels to accommodation show a less sharp rise at the lower values of convergence, but at higher values of convergence these curves, in general, also become tangent to a line parallel to the abscissa.

The curve at the maximum value of accommodation approaches a horizontal line parallel to the abscissa; this line is the line to which the curves of the other stimulus levels of accommodation become tangent at the higher convergence values.

These general trends are illustrated more clearly by the curves in Figure 16. The solid portions of these curves represent proximometer data while the dotted regions of the curves represent haploscopic data. At submaximal stimulus levels of accommodation the curves are seen to become parallel to the convergence axis in two regions: (a) in the region of the phoria, i.e., between the limits of positive and negative fusional convergence, and (b) in the region DE where all the curves become collinear. For stimuli equal to or greater than the maximum amplitude of accommodation, the first maximum reached is the maximum accommodation available, and consequently no subsequent rise above this level can be differentiated.

Most of the deviations of the data from the schematic representa-

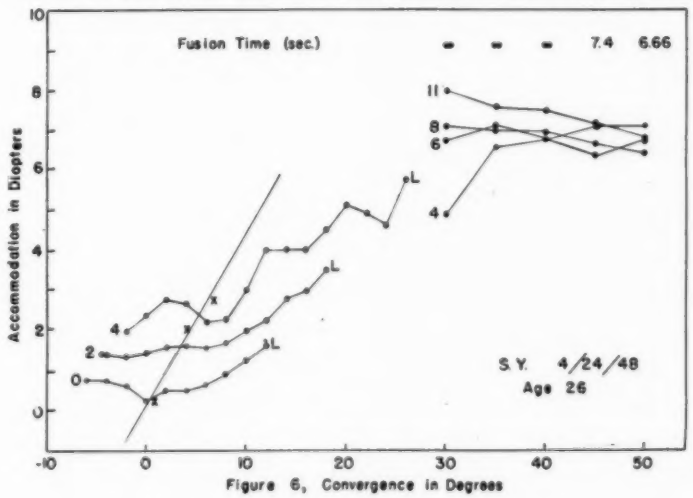


Figure 6.

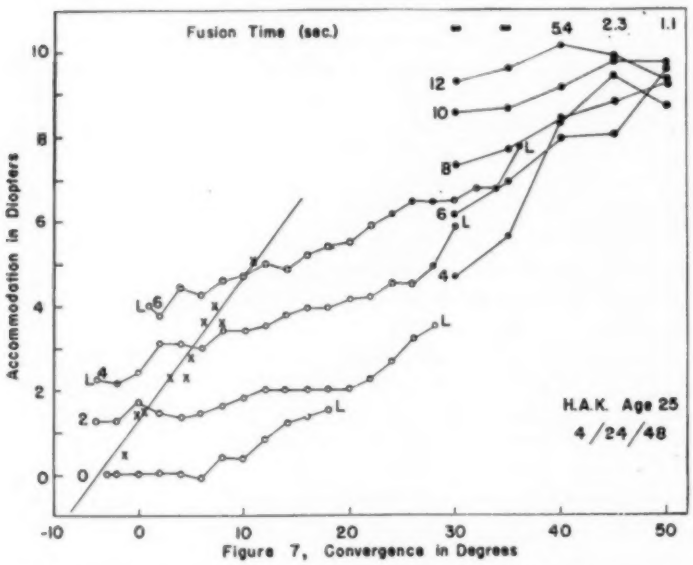


Figure 7, Convergence in Degrees

tion in Figure 16 may be explained on the basis of limitations of the instrument and experimental errors.

In certain cases the proximometric data were confined to region DE of Figure 16. In such cases it was not possible to measure on the

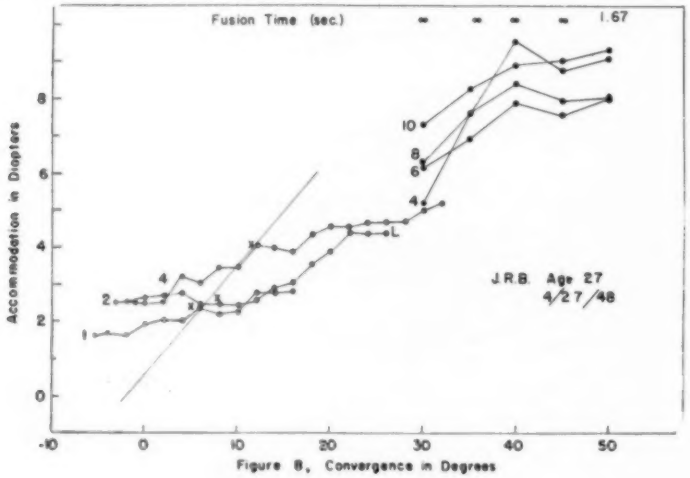


Figure 8, Convergence in Degrees

apparatus the region of the curves in which the maximum of accommodation is approached, since a minimum of 30 degrees of convergence was obtainable on the proximometer. This is best illustrated in Figures 9 and 14. That the maximum of accommodation at the near point is approached in precisely the same manner in these cases is illustrated, however, by the haploscopic curves which show the sharp rise in a region of convergence below the limit of the proximometer.

The extent to which the measurements at the higher values of convergence can be fit by a single straight horizontal line varies widely in the 12 subjects. Certain of these subjects (Figures 9, 10, and 14) show little if any deviation from the straight line fit, while others (Figures 3 and 4) show a fairly wide scattering of the measurements at the higher levels. It is reasonable to suspect that such differences which exist in these subjects are due to differences in the ability of the subjects to make repeatable measurements of the amount of accommodation in play at different moments.

As was pointed out in the description of procedure, the measure of the curves at the near point involved a psychophysical determination somewhat different from that obtained at lesser values of convergence by haploscopic methods. Since the results in psychophysical experiments are a function of the experimental procedure, some differences in the results obtained by the two methods were to be expected. In spite of this fact, the curves for the same stimulus to accommodation as determined by the two experimental procedures appear to mesh together with suffi-

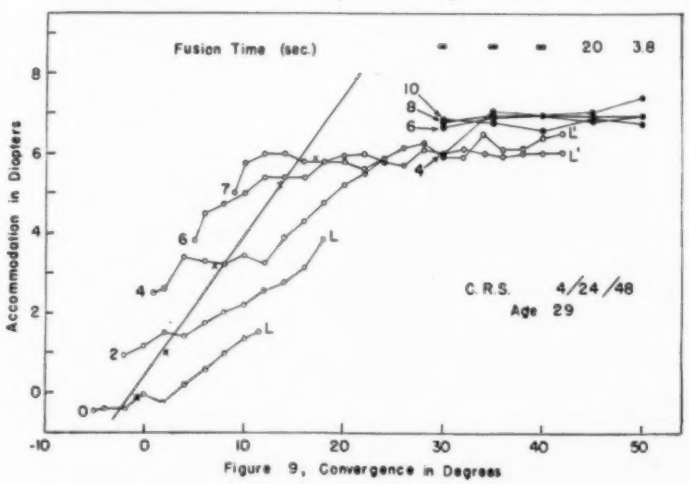


Figure 9, Convergence in Degrees

cient consistency to regard the two sets of data as supplementing each other and providing a complete depiction of the relation between accommodation and convergence. This is especially evident in those subjects in which the higher convergence regions of the haploscopic curves overlap the lower convergence regions of the proximometer curves (Figures 4, 5, 7, 9, and 14).

At the higher stimulus values to convergence, fusion could be maintained only intermittently. The length of time the subject could hold binocular fixation at the various values of convergence was obtained, and the average of five measurements of this time at each convergence value is recorded on the graph by a figure at the top of the graph placed accord-

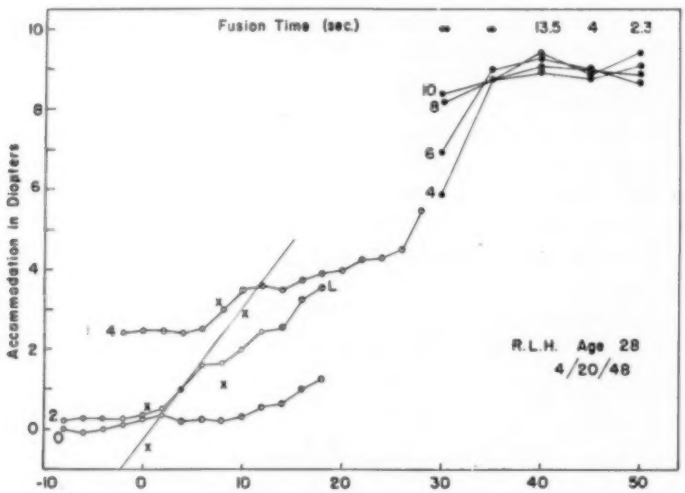


Figure 10, Convergence in Degrees

ing to the abscissa which represented the convergence for which the time was measured. If, at a given value of convergence, the subject maintained fusion for 20 seconds, it was arbitrarily assumed that he could have maintained this fusion indefinitely, and the time in which fusion could be maintained at this convergence was recorded as infinite.

It is seen that as the convergence approaches the maximum value the length of time that the fusion could be maintained decreased rapidly. This inability of the subject to maintain fusion over prolonged periods of time at the higher values of convergence became manifest objectively by a pendular disjunctive nystagmoid movement of the eyes.

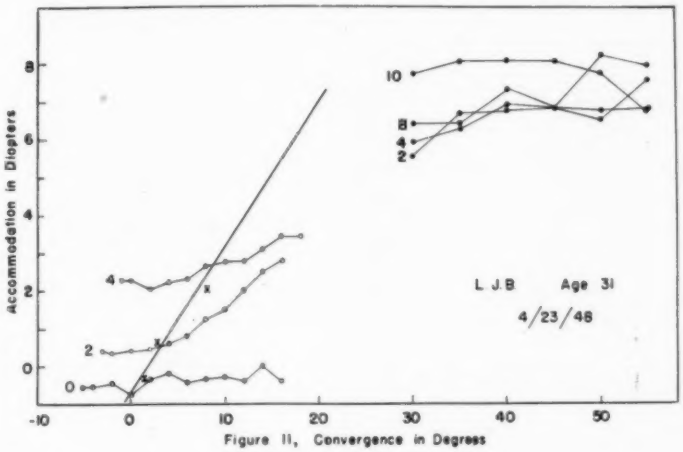


Figure 11, Convergence in Degrees

DISCUSSION

The projection DE of Figure 16 which was demonstrated in subjects JRB, CJB, RLH, SY, HWH, and TM, and was particularly manifested in subjects CRS, can be explained in at least one of two ways:

a. At any given age the amplitude is limited by the capacity of the lens to respond to the ciliary muscle, and there is always possible a greater amount of ciliary muscle contraction than that which is necessary to maintain the lens in its maximum accommodation state. This excess amount of ciliary contraction obviously could not be demonstrated by any increase in the refractive state of the eye, but could become manifest by an increase of accommodative convergence. According to this hypothesis, it would be possible for the subject to produce an increased amount of convergence at the maximum level of accommodation, which could not be brought into play at submaximal levels of accommodation, simply by exerting more ciliary muscle effort than that required to maintain accommodation at a maximum. The increased accommodative convergence so induced would account for the projection DE of Figure 16.

b. At any given age the amplitude of accommodation is limited by the capacity of the ciliary muscle to contract. Consequently, there is no excess ciliary contraction beyond that required to produce maximum accommodation. In this case the projection DE would depend upon fusional convergence. The limitation of fusional convergence at submaximal levels of accommodation

would be accounted for by a premature supplanting of the fusional convergence by accommodative convergence.

For the purpose of future investigation it should be pointed out that fusional convergence, in general, is susceptible to training[18]. Hence, one way of demonstrating whether the projection is due to fusional convergence would be to train the fusional convergence in subjects demonstrating a projection and repeat the measurements of the zone of clear single binocular vision. If the projection remained after an intensive course of training of the fusional convergence, then the likelihood that the projection might be due entirely to fusional convergence would be greatly reduced.

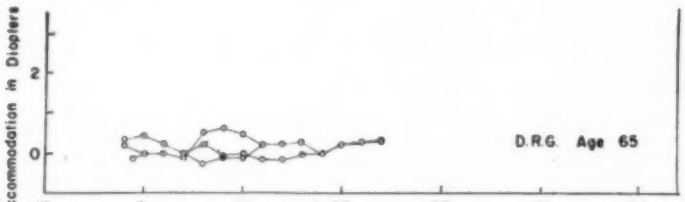


Figure 12, Convergence in Degrees

If it could be demonstrated that a projection could be developed in a subject who did not have one, by training the subject to bring into play his accommodative convergence in the course of overcoming base-in and base-out prism effects, then the likelihood that the projection might be due to accommodative convergence would be somewhat increased. In the present study one subject (Figure 13) seemed to demonstrate an inability to employ accommodative convergence to overcome base-in and base-out prism effects at submaximal stimulus levels to accommodation. If the projection DE of Figure 16 were dependent upon the use of accommodative convergence, the projection would not be expected to appear in this type of a subject. However, in this case a projection did appear, and it has not been possible to determine the cause.

The subject in Figure 3 appears at first glance to belong to the same category as the subject in Figure 16. However, it should be noted that the convergence limit of the haploscope is reached prior to the time that the eye goes out of focus, and it is possible that the eye would have gone out of focus to maintain fusion at higher convergence values.

All of the other subjects demonstrated an ability to use accommodative convergence at submaximal stimulus levels of accommodation in order to overcome base-in and base-out prism effects. Of these cases, some (Figures 4 and 7) failed to show any projection whatsoever, while others (Figures 9, 10, and 14) show a rather prominent projection.

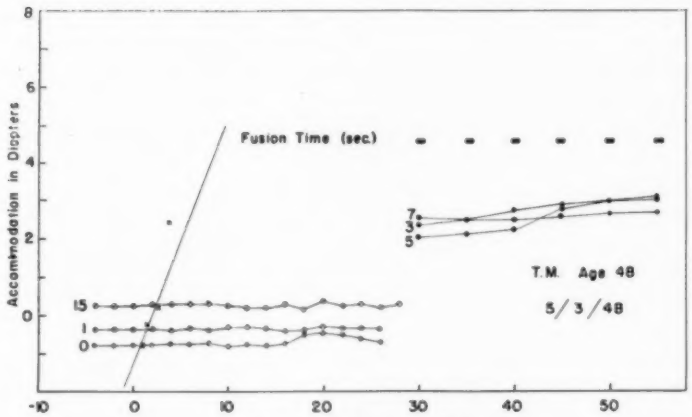


Figure 13, Convergence in Degrees

The group which failed to show a projection constitutes some support to the theory that the region of latent ciliary muscle contraction does not exist, and that maximum ciliary muscle contraction is necessary to produce maximum amplitude of accommodation. It does not seem likely that an individual who could employ accommodative convergence to maintain fusion at submaximal levels of accommodation, thereby causing the images to blur, could not bring accommodative convergence into play at a maximum level of accommodation when the images would not blur.

The group which demonstrates the projection DE of Figure 16 does not constitute evidence which definitely verifies either theory of

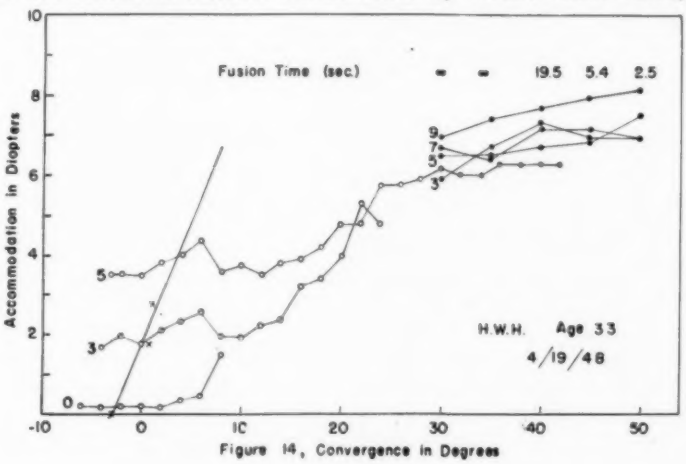


Figure 14, Convergence in Degrees

accommodation. This is true because it was not actually determined whether the projection was due to accommodative convergence or whether fusional convergence at submaximal levels of accommodation was prematurely supplanted by accommodative convergence.

One major aspect of this problem is the effect of age on the accommodation and convergence functions.

The first effect to be considered is the variation of the ACA ratio with age.

Alpern and Hirsch[1] made a statistical analysis of the variation in the ACA ratio (as determined by clinical tests) with age in 1,202 clinical cases, as well as an analysis of haploscopic determinations of the ACA ratio in five individuals over a ten-year period. The results of the statistical study are plotted in Figure 17. It was concluded from these investigations that the ACA ratio does not increase with age as might be expected on the basis of the theory that maximum amplitudes of accommodation requires maximum ciliary muscle contraction at all ages.

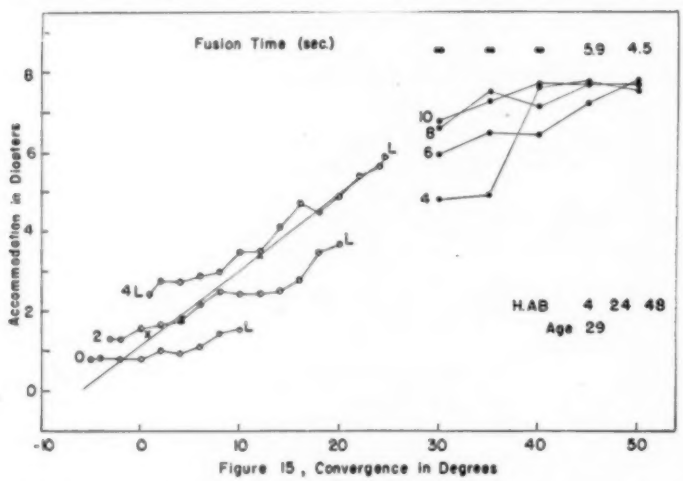
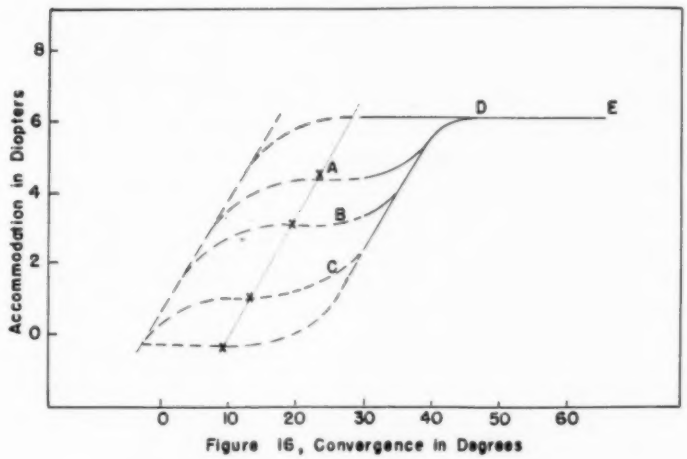


Figure 15, Convergence in Degrees

It is important to point out that the action of age upon the accommodative mechanism is fundamentally different from the action of drugs which partially paralyze the ciliary muscle. Studies have shown that when the ciliary muscle becomes partially paralyzed, the eye not only loses its ability to accommodate but the ACA ratio increases, and the amount of increase in the ACA ratio is an indication of the extent of paralysis of the ciliary muscle[8, 20].

From the data in Figure 17, however, it is apparent that no cor-



SCHEMATIC REPRESENTATION OF DATA

responding increase in the ACA ratio accompanies the inability of the eye to accommodate for near objects which is associated with increased age.

This fact would be explained on the basis that the effect of age is to increase the consistency of individual fibers of the lens, the sclerosis progressing from the central fibers gradually out towards the more peripheral ones, with a greater number of fibers becoming sclerosed as age progresses. Those fibers which are not sclerosed, however, are as susceptible to the changes in tension of the fibers of the zonule as they ever were.

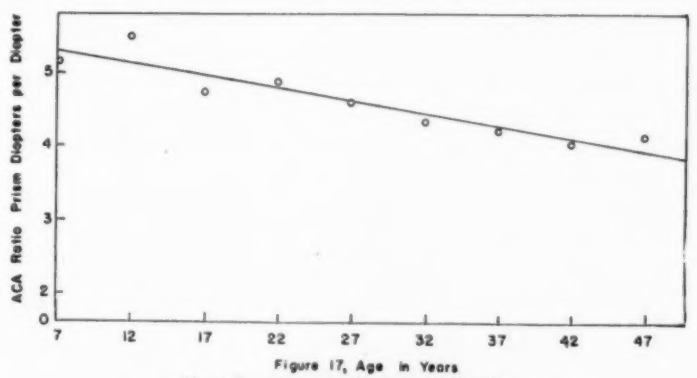


Fig. 17. Data of Alpern and Hirsch[1].

If all the fibers of the lens gradually sclerosed together, the effect of age on the ACA ratio would be similar to what occurs with partial paralysis of the ciliary muscle with cycloplegic drugs. That is, the ACA ratio would gradually increase as the degree of sclerosis of all the lens fibers increased with age.

The second effect to be considered is the variation of the total convergence with age.

Table I
(From Data of Duane[5])

Age (in years)	Maximum Angle of Convergence Mean in Degrees
Less than 16	49.8
16-25	48.6
26-35	47.8
36-40	46.6
41-45	45.6
46-50	44.2
Greater than 50	42.8

In 1926 Duane[5] published the results of measurements of the near point of convergence in 280 subjects. The results are presented in Table I. In this table the first column is the age groups in years, and the second column is the mean of the near points of convergence in degrees for the subjects in the various age groups. It is seen from these data that although there is a decrease in the near point of convergence with age this decrease is very small. As Duane, himself, states[6]:

". . . The probability, in fact, is that the actual converging power does not diminish with age. Those who are old usually find it rather more difficult to exert converging power when called upon to do so, simply because they are out of practice, having for years had no occasion to converge as young persons do. With practice, no doubt, most of them could learn to converge almost as well as ever."

Since both the ACA ratio and the total convergence remain essentially unchanged with age and if the amount of fusional convergence remains constant with age, the amount of the projection DE of Figure 16 should increase with age. This has been diagrammatically represented in Figure 18 (A and B) which illustrates the nature of the expected zones of clear single binocular vision at two different ages.

This effect is best illustrated in Figure 13. The projection DE in this case is quite extended in spite of the fact that at lower stimulus levels to accommodation the subject was unable to bring into play accommodative convergence to overcome base-in and base-out prism effects.

In studying the effect of age in such cases it might be worthwhile to point out that the subject should not be too old. This is evidenced by the record of DRG, age 65, (Figure 12) in which the amplitude is

so reduced that it is impossible to differentiate the projection DE from the rest of the data of the zone of clear single binocular vision.

One qualitative observation which lends support to the theory that the projection DE of Figure 16 is due to accommodative convergence is the voluntary character of the binocular fixation at convergence values represented along the projection. This characteristic was manifested not only by the appearance of periodic diplopia and the necessity of the subject maintaining intense effort in order to fuse the images, but also, objectively, by the nystagmoid movements of the eyes which occurred during these periods of intense effort. If the effort to maintain convergence was relaxed, the images broke and the nystagmoid movements ceased.

The voluntary character of the convergence along the projection DE of Figure 16 tends to preclude the possibility that the excess of convergence at the maximum level of accommodation is fusional convergence. That fusional convergence is automatic is evidenced by the nature of the vertical fusion movements. That accommodative convergence on the other hand is under some amount of voluntary control is evidenced by

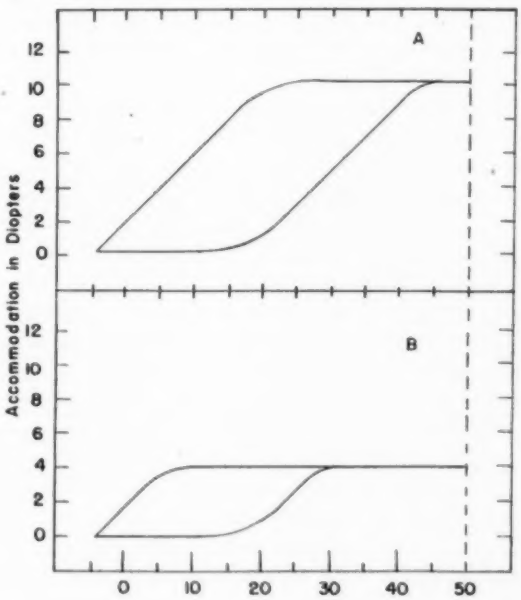


Figure 18, Convergence in Degrees

the ability of a trained observer to throw his eyes out of focus in order to produce any desired diplopia and then to use the amount of diplopia to regulate the amount of convergence of the eyes desired.

SUMMARY AND CONCLUSIONS

Measurements of the zone of clear single binocular vision of maximum levels of accommodation have been made using the proximometer on 12 subjects.

On the basis of these data it may be concluded that:

1. The effect of age on the ACA ratio is fundamentally different than the effect of drugs which partially paralyze the ciliary muscle. In the latter case the ACA ratio increases as the amplitude decreases.

2. The zone of clear single binocular vision in some cases is characterized by an increase in the positive relative convergence at the maximum level of accommodation which is larger than would be predicted from the characteristics of the zone at submaximal levels.

3. It cannot be determined from the available data that this increased convergence is accommodative convergence. The fact that it is under volitional control seems to indicate that it is. The fact that it occurred in a subject who could not bring accommodative convergence into play to maintain binocular vision at submaximal levels of accommodation, however, seems to indicate that this excess of convergence at the maximum level of accommodation is not accommodative convergence.

4. The fact that this excess of convergence at the maximum level of accommodation could not be demonstrated in all of the subjects seems to lend some question to the hypothesis of Hess that there is in all persons an amount of ciliary contraction possible which is greater than that required to produce maximum accommodation. It is possible, however, that the projection of the zone which was demonstrated in some of the subjects at the maximum level of accommodation did not represent an excess of convergence at the maximum level of accommodation but rather a deficiency of convergence at the lower levels of accommodation produced by a premature supplanting of fusional convergence by accommodative convergence.

5. Inasmuch as age does not affect, appreciably, the total amplitude of convergence and the ACA ratio does not increase with age the extent of the projection of the zone of clear single binocular vision at the maximum level of accommodation can be predicted to increase with age. This constitutes some support for the hypothesis that the ciliary muscle has the ability to contract which is greater than that required to produce maximum accommodation. Some verification of this was found in one

subject, age 48, who demonstrated a rather extended projection of the zone at the maximum level of accommodation.

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INDUSTRIAL VISUAL CARE*

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THE PROBLEM

During the past decade many agencies have been interested in the problem of industrial visual care. Many of these had no connection with the existing groups engaged in the eye field, yet their work and practice contributed materially to the economics of the eye professions. Also, it must be conceded that such work forced the realization that the eye professions had been remiss in their duties. Any student of the industrial vision problem cannot help but feel both an obligation and respect for the pioneering work of such men as Julius King of the American Optical Company; the late Harry Guilbert of the Pullman Company; A. A. Hendrix of General Motors Corporation; H. L. Logan of the Holophane Company, and many others of the same vision and zeal in this work. Space, unfortunately, permits mentioning only a few of these outstanding contributors.

Harry Guilbert once made a statement to the writer which impressed him deeply, "There have been many excellent books written on the treatment of eyes after accidents, but few on how to prevent such accidents." Any eyeman in his daily practice, seeing and noting the results of previous accidents to the eyes of his patients, cannot help but be concerned, for if he studies the problem of industrial vision even superficially, he quickly learns that the work he is doing in attempting to correct visual anomalies is far from complete until he, personally, makes an honest attempt to aid in preventing such accidents. He soon arrives at the very obvious conclusion that the least he can do is to encourage the use of eye-protective devices.

Several years ago, Mr. A. A. Hendrix made the succinct statement, "Basically, when we hire an individual we attempt to utilize his natural gifts, whether it is brain or brawn, in jobs best fitted for him. Actually, we hire eyes. We employ seeing eyes. How well they perform at their work over a long period of time has been little considered." And the truth of the matter is that many of us practicing eye work have not considered this either.

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Some time ago the writer broke down the problem of industrial visual care into several separate approaches. Each is important and all must be integrated for a successful industrial visual care program. These are in brief:

I. Protection of eyes against injury.
   (a) Safety supervision.
   (b) Safety education.
   (c) Personal protective equipment.
   (d) Guarding of work process and machine.
II. Conservation of vision measures.
   (a) Adequate lighting.
      1. Point of operation.
      2. General.
   (b) Contrast painting and other environmental factors.
   (c) Visual aids.
   (d) Education in eye hygiene for the worker.
III. Relationship of good vision to safety, efficiency and comfort.
   (a) Methods for determining.
      1. Rough screening for weeding out purposes.
      2. Job visual requirements.
      3. Visual job analysis.
      4. Conventional examination for those in need.
   (b) Methods for correction.
      1. Corrective and/or protective glasses for those in need.
      2. Working glasses for those in need.
      3. Other visual aids.
   (c) Results of efficient vision.
      1. Less accidents.
      2. Less spoilage.
      3. Faster and more efficient work.
      4. Improved morale.
IV. Economics of visual care.
      1. Increased income.
      2. Decreased costs of manufacturing.

It must be rather obvious that all optometrists cannot or will not engage actively in industrial visual care. Some do not have the time; some practice in localities far removed from industrial centers, and others do not have the interest. All of us, however, can contribute by actively encouraging eye protection and conservation of vision both at work and in the home.

Protection of eyes against injury has been developed to the point

where hardly an operation exists that does not have an adequate eye guard designed for it. An industrial optometrist must not only be familiar with the principles of eye safety, but also must know the applications of devices to guard the eyes against injury.

Conservation of vision measures are part and parcel of an optometrist's work. He works with light as a daily routine. The laws of reflection and refraction are an old story to him. Therefore, further application of his training is a natural and progressive step. Ease of seeing by means of adequate light and its supplement, paint, is as important as the correction of visual anomalies by means of lenses or orthoptics.

The utilization of working aids for eyes in the form of working glasses, magnifiers, loupes, etc., is but a part of the work of the optometrist. If one knows the visual demands for the task at hand, it is a relatively simple matter to arrive at an adequate solution.

The principles of eye hygiene are common knowledge and should be encouraged by all of us.

Actually, the average optometrist has been demonstrating the relationship between efficient vision to safety, work efficiency and comfort for years. Unfortunately many optometrists have not appreciated it. The public, particularly the workers have, else why would the profession be doing the bulk of the refractive work? To make himself even more indispensable to the civilization in which he lives, he need only to observe the uses and abuses to which his patients' eyes are subjected in everyday work life. An industrial optometrist merely applies the knowledge and training that he already has to industry . . . both from a visual capability and job visual analysis standpoint. There is no need for secrecy; no need to apply cumbersome statistics; or no unusual skill needed. Observation, coupled with the knowledge and training that he now possesses, and practically applying these is all that is required.

Without knowing the visual status of a particular worker on a specific job, practically any competent eyeman can determine, with a high degree of accuracy, the visual requirements of the job when certain basic information is obtained. These factors are, in order of their importance:

1. Work distance or distances.
2. Size of object worked upon.
3. Special work demands.
4. Working environment.

If, on the other hand, the visual status of the worker is known, it is a relatively simple matter to prescribe the proper correction for the job at hand.

The truth of the whole matter of industrial vision, particularly in respect to the determination of visual standards, is that the responsibility for any phase of it rests upon the shoulders of the individual eye practitioner in the community. No matter what type of visual program is instituted by any agency other than the eye professions, the final determination of the individual ocular status is both legally and logically the job of the eye practitioner and therefore the success or failure of such a program is dependent solely upon him.

APPROACH AND CONTACTS

Like any other endeavor, a method of procedure must be developed by the practitioner engaging in industrial work. This will be a variable and conditioned by the particular plant involved. If the job calls for a program of eye protection alone, for example, he must be prepared to work with the safety department, if one exists, or with the shop safety committee. Each has a different method of approach and procedure. In the first example, he must become familiar with the existing safety rules and plant procedure and his work probably will be consultation only. In the second example, his work might well include setting up eye safety regulations, ordering of protective devices, fitting and adjusting.

For the protective phase only, contact is generally made through the safety department in the larger plants and shop superintendent or foreman in the smaller ones.

In a conservation of vision type program, the industrial optometrist generally works with the plant engineer in the larger plants. In the smaller ones, the owner or plant superintendent is consulted. It is generally good practice to discuss problems of lighting with the local utility company. The company invariably is cooperative and will assist in many ways. The larger painting companies also cooperate when such problems are presented to them.

When complete visual programs are contemplated the problem becomes more complex. In addition to those mentioned above, others now enter the picture since the work will affect the various departments. The personnel department is vitally interested for it not only hires, but places workers. The time and motion study department becomes interested, for the work has a distinct bearing on its functions. The medical department must be consulted, for the health of the workers is its concern. (It is always good practice to work harmoniously with the medical department of any plant. This generally eliminates friction and misunderstanding and ofttimes insures success for a program.)

In the larger plants it is well to meet with the labor management

committee and explain what work is contemplated and how it will be conducted.

It has been the experience of the writer that top management usually is interested in the welfare of its employees and therefore welcomes any worthwhile endeavor. The writer has always dealt with top management, even though the request for his services originated in one of the departments mentioned above. This saves valuable time and insures smooth running of the program. After the program is in effect, it is good practice to work directly with the department head. All reports, however, should go to top management with copies to the medical department and others who might have an interest in the particular phase of the problem with which one is working. Contemplated changes in procedure or policy must be discussed with top management before going ahead.

It is well to remember that most factory managers are busy men and the program which, to you, might be the most important thing in the universe is but a small part of their problems. Therefore, when any business pertaining to the work of eye service is necessary, make an appointment, present your information briefly and concisely, and keep your discussion short and to the point. Management will listen to you and thank you for your courtesy.

PROGRAM PROCEDURE

After the contact is made, the matter of work to be performed must be determined. In any phase of the program, be it protection of eyes, conservation of vision procedures, or the determination of the relationship between good vision, production, and efficiency, a method of procedure is as follows: Make a survey of the plant: the number of employees: the existing personnel, safety, and health facilities: the product manufactured and the most important part of the visual program which must be given first attention. The work sheet is as follows:

JOB VISUAL ANALYSIS

Date ..... Job Title ..... Class of Operation .....
Time ..... Material ..... Product .....
Job Rating ..... Department .....

ENVIRONMENT

Illumination: General ..... Specific ..... Glare .....
Reflection ..... Heat ..... Ventilation .....
Work Placement ..... Hazards ..... Impacts .....
Splashes ..... Fumes ..... Gases ..... Dust .....
Machine ..... Protection ..... Existing .....
Potential .....

VISUAL DEMANDS

Work Distances ..... Average ..... Specific .....
All ..... Visual Aids ..... Color ..... Materials .....
Occupational ..... Size ..... Color ..... Materials .....
Manufacturing Tools ..... Tolerances .....

Rough notes are made next to the subtitles and studied at leisure. Suggestions are then made in collaboration with the plant engineer, safety engineer and the time study engineer either on the same sheet or on another as follows:

SUGGESTIONS FOR IMPROVING FACTORS FOR INCREASED VISUAL EFFICIENCY

ENGINEER

ILLUMINATION

General ..... Specific ..... Painting .....
Surround ..... Machine ..... Heat .....
Ventilation ..... Guarding ..... Point of .....
Operation ..... General Housekeeping .....
Health Demands ..... Job Rating .....
Tolerances .....

CONSULTING EYE MAN

EYE PROTECTION

Goggles ..... Type ..... Number .....
Lenses ..... Type ..... Size ..... Face .....
Shields ..... Helmets ..... Hoods ..... Visual .....
Aids ..... Loupes ..... Magnifiers .....
Working Glasses ..... Corrective Rx .....
Corrective-Protective Rx .....
Needed Visual Skills for Job .....

It can well be seen from this outline that any phase of an industrial visual program can be studied and acted upon.

If protection of eyes is the most important consideration, one need but discuss eye safety procedures with the safety engineer. If conservation of vision measures are to be considered the most important, such an outline opens the way for discussion of this phase of the work in conjunction with the plant engineer, electrician and local utility company.

Where work tolerances are high and other visual demands are exact, the use of visual aids must be considered. This naturally leads to the problem of ascertaining the visual capabilities of the individual worker and consequently the time and motion study engineer enters the picture. This phase of the problem, of course, leads to the installation of a complete visual program and the method of setting up such a program depends entirely upon the professional man and management. Broadly speaking, if the plant is small with 100 workers or less, a conventional examination for all personnel can be easily instituted. Where the number of workers exceeds the amount possible for the average practitioner to adequately care for, other means must be found to roughly ascertain the visual status of the workers. This naturally leads to the use of screening devices. Let it be remembered, however, that wherever screening programs are used, the control must at all times be under that of the professional man. In such a manner a workable procedure can be developed, which can be modified to suit the demands of the individual plant.

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PSYCHOLOGISTS MOVE TOWARDS LEGISLATION

Indications are that psychologists, working through their national societies, will make a determined effort to secure state recognition as health workers with proper license, at coming sessions of state legislative bodies in January, 1951.

For some time now psychologists have been active as fringe health workers in educational centers, clinics and industry, and a considerable number of these specialists have become convinced that state registration of psychologists is the only effective method of keeping untrained persons out of the field of psychology.

We have been informed that a *Model Bill* has been prepared and distributed by a national society of psychologists to local groups. These psychologists, at the local level, are now laying the groundwork to intro-

duce this legislation as soon as the state legislative sessions get under way.

Just what constitutes the field of psychology in health work has not been made clear. It is safe to assume that if this new move is successful, psychologists will, as clinical practitioners, invade at least the fields of psychiatry and optometry, and perhaps go much farther.

Our state optometric legislative specialists should become alerted to this possibility. These optometric officials, working with state medical association officers should give this new health development serious study.

CAREL C. KOCH

MONOGRAPH BY SHEARD ON OPHTHALMIC OPTICS— A COLLECTOR'S ITEM

During this year, Volume II of Medical Physics* has been published. In this work is found a chapter written by Dr. Charles Sheard, Professor Emeritus of Biophysics, Mayo Foundation for Education and Research in Medicine, University of Minnesota. This chapter contains a most valuable condensation of pertinent data. The material presented by Sheard is up-to-date and in every sense authoritative. It is written by one of the world's masters of the subject. His chapter is entitled, *Ophthalmic Optics with Applications to Physiological Optics.* It is written for the clinical practitioner in easily understood language and the author brings out the basic principles underlying much of our work in a way possible only in the hands of a renowned scientist and writer.

This essay covers the index of refraction; refraction by prisms and curved surfaces; thick and thin lenses; focal powers, effectivity, decentration and aberration of modern ophthalmic lenses; lens design, special and bifocal lenses and related topics.

The material by Sheard covers 42 large size pages, (type size 6″x 9″ in two columns to each page). This chapter on *Ophthalmic Optics* has been reprinted as a special monograph in a limited quantity of only 300 copies, each bound with cloth cover, gold stamped. While they last, copies of this monograph may be had from the author by addressing Dr. Charles Sheard, P. O. Box 543, Rochester, Minnesota, and enclosing a check for $3.00 to cover the cost of binding and postage.

Optometrists wishing to add to their libraries, this latest scientific contribution to our science by Sheard, should write him at once. A letter requesting him to autograph your copy may also be successful, in that event making the book a doubly rare collector's piece for any optometric library. CAREL C. KOCH.

*The Year Book Publishers, Inc., 200 East Illinois Street, Chicago, Illinois.

SHORT COURSE IN ANISEIKONIC WORK

The section on aniseikonia of the American Academy of Optometry has received requests to the effect that a short graduate course be arranged for suitable training in the basic procedures followed by Aniseikonic Clinicians.

Since the Academy section on aniseikonia is not prepared to give such a course this year, it has sought the assistance of the Aniseikonic Forum which has cooperated with various teaching institutions and individual lecturers in providing lantern slides, mimeographed notes and other materials for instructional purposes.

The Aniseikonic Forum has hesitated in planning a course because of the current lack of eikonometers. However, the Aniseikonic Forum has been informed recently that the American Optical Company will have instruments available for delivery "in late December or more likely in January." The American Optical Company has also offered to provide a pilot model of the new eikonometer if a course in December develops. Furthermore, the Chicago College of Optometry has offered to cooperate with the Aniseikonic Forum and to provide space for a course in aniseikonia if such a course materializes.

Therefore, it becomes apparent that an intensive three-day course in aniseikonia may be possible on *December 13, 14 and 15*. Drs. Robert E. Bannon and Harold M. Fisher, both of whom are aniseikonic specialists with faculty experience at Columbia University, would be willing to serve as instructors. The proposed course would consist of a minimum of 15 hours of lectures, demonstrations and actual use of the instruments. Tuition would be $50.00 a student. The place, Chicago.

Application for this course should be sent directly to Dr. Robert E. Bannon, Secretary, Aniseikonic Forum, Lang Building, Hanover, New Hampshire, with a check for $25.00. The balance of tuition is payable at the start of the class. In the event that a sufficient number do not enroll and the course is not given, the deposits received will be returned.

CAREL C. KOCH

PUBLISHER'S NOTICE:—A special subscription service has been arranged to assure subscribers in military service of receiving their copies of this magazine each month. Subscribers are urged to immediately forward changes in their military mailing addresses as these occur, giving name and rank, service unit, hospital, camp, naval port or air base. Journals will be individually forwarded to men in service irrespective of the number of month-to-month changes that occur.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

TWENTY-NINTH ANNUAL ACADEMY MEETING

CHICAGO, ILLINOIS, DECEMBER 16-19, 1950

In past years, Academy members have attended annual meetings for many good reasons—fellowship, mental stimulation, a chance to meet and hear outstanding scientists, and discuss common problems.

This year, critical world conditions create another, and more urgent reason for attending. President D. G. Hummel succinctly sums it up in the following message to all Academy Fellows:

In these days of dangerous international unrest it has become increasingly apparent that the professions have an added responsibility in maintaining and improving the health of the nation.

The interchange of scientific thinking has constantly resulted in the improvement of the general welfare of all people. That this meeting of minds in Academy sessions has contributed to scientific thinking over the years is a well established fact.

A study of the program outlined in this issue should give you all the incentive needed to attend the convention. Hearing the speakers and the discussions is the only way you can receive the maximum benefit from this meeting.

THE PROGRAM

Five Fellows have worked continuously since the Cleveland meeting on the coming Chicago program: Drs. Robert E. Bannon, chairman; Hanover, New Hampshire; Dr. Eugene Freeman, and Dr. Jack Copeland, of Chicago, Illinois; Dr. Henry W. Hofstetter, Los Angeles, California, and Dr. William Sinn, Philadelphia, Pennsylvania.

This committee has worked up an unusually well balanced program of excellent papers. As stated by President Hummel, a study of the speakers and topics should be ample assurance there is profit in attending the sessions. The following program submitted by Dr. Bannon's committee is, of course, subject to last minute changes.

REFRACTIVE AND GENERAL SCIENCE PAPERS

"The Effects of Variations in the Acid-Base Balance on Visual Thresholds," by Dr. Mathew Alpern, The Ohio State University. "A Study of the Flattening Effect Produced by Optical Magnification," Dr. S. Howard Bartley, Michigan State College. "The Prescription of Base-in Prisms," Dr. George A. Parkins, Ord, Nebraska. "Some Psychological Factors of Flicker and Fusion," Dr. George W. Knox, The Ohio State University.

"Subjective Appraisal of Brightness," Mr. Sylvester A. Guth, General Electric Company, Nela Park, Cleveland, Ohio. "Trifocal

Lenses—A Clinical Study Based on 22,640 Prescriptions," Dr. Robert E. Bannon, Hanover, New Hampshire. "Accommodative-Convergence in a Patient with Adie's Pupil," Dr. Meredith W. Morgan, University of California.

"Some Aspects of the Psychology of Binocular Vision," The Lord Charnwood, London, England. "Operational Analysis of Optometric Concepts," Dr. Eugene Freeman, Chicago College of Optometry. "Compensatory Cyclotorsion and Visual Acuity," Dr. William G. Walton, Pennsylvania State College of Optometry. "Relationship of Proximal Convergence to Fusional and Accommodative Convergence," Dr. Henry W. Hofstetter, Los Angeles College of Optometry. "Counselling in Ocular Genetic Problems," Dr. Harry Jankiewicz, Los Angeles College of Optometry.

"Effect of Aniseikonia on the Amplitude of Vertical Divergence," Dr. Vincent Ellerbrock, The Ohio State University.

HISTORY AND ANIMAL STUDIES

"One Hundred Years of the Ophthalmoscope, von Helmholtz, the Man, his Life, and his Work," Dr. William P. Schumann, Vineland, New Jersey.

"The Problem of Eyelessness Among Cave Animals," Dr. Arthur Shlaifer, Pennsylvania State College of Optometry.

PAPERS ON CURRENT PROBLEMS

"The Optometrist and War-Time First Aid," by Dr. John C. Neill, Pennsylvania State College of Optometry. "Gearing Optometry to the Atomic Era—A Blueprint for 1951-1999," Dr. Ernest A. Hutchinson, Los Angeles College of Optometry. "Public Relations in Optometry, As Viewed by a College Dean," Dr. Richard Feinberg, Pacific University.

INDUSTRY AND SCHOOLS

"Industry and the Optometrists," Dr. Roy Marks, Bausch & Lomb Optical Company, Rochester, New York. "Simple Method for Evaluating Adeptness for Color Recognition in Industry," Dr. William Smith, Massachusetts College of Optometry.

"Factors Related to Monocular and Binocular Reading Efficiency," Dr. Helen M. Robinson, University of Chicago Reading Clinics. "Effect of School Experience on Refraction of Children," Dr. Monroe J. Hirsch, Los Angeles College of Optometry.

PATHOLOGY

"Endocrine Disturbances and Their Effects Upon the Eyes," Dr. Isadore Kaplan, Philadelphia, Pennsylvania. "Headaches," Dr.

Harold Simmerman, Pennsylvania State College of Optometry. "Scleral Tonometry," Dr. Henry L. Wolfe, Marshalltown, Iowa. "Retinopathy Resulting From Circulatory Disturbances," Dr. W. O. Vivian, Media, Pennsylvania.

BANQUET SPEAKER

Dr. Henry A. Imus of the Office of Naval Research, Washington, D. C., will be the annual Round Table banquet speaker Monday evening, December 18. Dr. Imus' topic will be, "Fundamental Research in Vision."

SECTION SESSIONS

Section meetings will start at 9:00 A.M. and adjourn at 11:00 A.M. on Sunday, Monday and Tuesday (December 17, 18, 19). Section chairmen are Dr. Harold Fisher, Mt. Kisco, New York, aniseikonia; Dr. John C. Neill, Philadelphia, Pennsylvania, contact lenses; Dr. J. Donald Kratz, Souderton, Pennsylvania, orthoptics, and Dr. William O. Vivian, Media, Pennsylvania, pathology.

As in 1949, the aniseikonic, contact lens and orthoptic sections will meet concurrently, and the lectures planned by the pathology section will be general sessions.

PROBLEMS FOR EXECUTIVE COUNCIL

Members who have matters to take up with the Executive Council are urged to prepare proposals and present them either during the preconvention sessions December 14 and 15, or during Council sessions held during the convention, December 16, 17, 18 and 19. Appointments for these conferences with individuals or groups are now being scheduled.

CONVENTION HEADQUARTERS

Convention headquarters will be one of Chicago's finest hotels, The Drake, on the shores of Lake Michigan, Near North Side. The hotel has reserved a block of rooms for all Academy members and guests, and early reservations obviously will be given preference. Restaurant accommodations in The Drake include the atmospheric Cape Cod Room and the sparkling, sophisticated Camellia House dining room. Make your room reservations now!

VIRGINIA HUCK

CONTACT LENS SPECIALISTS CERTIFIED

An Academy idea born three years ago is now a *fait accompli*. In Philadelphia, in May, 1947, a program to certify contact lens specialists was discussed. The idea took form at the Chicago annual meet-

ing in December, 1947, and under the direction of Dr. John C. Neill of Philadelphia, an examining board was subsequently set up to screen and examine trained contact lens specialists and award special diplomas to qualified applicants.

This month, Dr. Neill, chairman of the Academy contact lens section, announces the certification of the following members. These men have completed their work to qualify as diplomates of the section, and have been awarded a special Academy certificate.

Dr. L. Lester Beacher, 236 North Walnut Street, East Orange, New Jersey.
Dr. Otto J. Bebber, 1477 Penn, Denver, Colorado.
Dr. Henry B. Day, Jr., 603 Security Bank Building, Raleigh, North Carolina.
Dr. Vincent J. Ellerbrock, School of Optometry, Ohio State University, Columbus, Ohio.
Dr. William Feinbloom, 138 East 36th Street, New York, New York.
Dr. Isadore Finkelstein, 1501 Broadway, New York, New York.
Dr. Irving P. Filderman, 811 Three Sisters Building, Memphis, Tennessee.
Dr. Eugene Freeman, Chicago College of Optometry, 1849 Larrabee Street, Chicago, Illinois.
Dr. Robert C. Graham, 548 Parkway Building, 117 East Colorado Street, Pasadena, California.
Dr. Arthur E. Hoare, Room 607, 609 South Grand Avenue, Los Angeles, California.
Dr. D. G. Hummel, 418 National City Bank Building, Cleveland, Ohio.
Dr. Russell S. Manwiller, 5224 Spruce Street, Philadelphia, Pennsylvania.
Dr. Bernard Mazow, 1013 Shell Building, Houston, Texas.
Dr. Meredith W. Morgan, Jr., School of Optometry, University of California, Berkeley 4, California.
Dr. John C. Neill, 5128 North Broad Street, Philadelphia, Pennsylvania.
Dr. J. S. Nupuf, 1342 North Cleveland Street, Canton, Ohio.
Dr. William W. Policoff, 68 South Franklin Street, Wilkes-Barre, Pennsylvania.
Dr. Nathan A. Robbins, 211 Linwood Avenue, Buffalo, New York.
Dr. I. Irving Vics, 402 State Bank Building, Albany, New York.
Dr. Irving Weiss, 300 Main Street, New Britain, Connecticut.
Dr. S. G. Weiss, 24 Church Street, Torrington, Connecticut.

CURRENT COMMENTS

Virginia Huck
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department: such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

BRITISH HEALTH AUTHORITY PLANS U. S. TOUR

The British Health Scheme has been watched with more than passing interest by Americans since it was first proposed in 1946. Interest has grown even keener since United States administration leaders have plumped for similar legislation here. But factual reports from England have been difficult to obtain. Therefore, it is with pleasure we learn that a British authority on the subject is planning a trip to the

States next year, and will be available for a limited number of speaking engagements dealing with the subject of socialized medicine as it now operates in England.

Dr. J. Ross-Mansell, Secretary of the Institute of Optical Science and a private optometric practitioner, will arrive in New York in April, 1951. The Institute is the only optical organization in England where ophthalmic surgeons are on the Council, and where ophthalmic surgeons are on the teaching staff of its school. Officers and program chairmen of optometric associations wishing to schedule Dr. Ross-Mansell should write him at once at 202 Station Road, Edgware, Middlesex, England, to schedule a specific date for his appearance at their meeting. While Dr. Ross-Mansell has been a leading critic of the Scheme, in his talk he will review both the advantages and disadvantages of this public health program. His topic will be, "The Optometrists and Patients Under Socialized Health Care in England."

The Journal will carry more information on the scheduled tour next month. At present, the following facts are settled: Dr. Ross-Mansell will arrive in New York in April, and stay in this country three weeks. He will arrange his own itinerary based on requests received from optometric leaders in this country wishing him to talk before their groups, so contact him as soon as possible.

TELEVISION HARMLESS, SCIENTISTS REPORT

Most everybody's been wondering what effect television has on the eyes. Now we can stop worrying, for in most cases it's harmless, say scientists at the Institute for Research in Vision of The Ohio State University.

The Institute's advice is based on the results of a poll of refractionists, asking (1) What increase in eyecare is being brought about by television? (2) What visual difficulties are being found which can actually be traced to television? (3) What advice and help professional men can give and are giving to television viewers?

The questionnaire was prepared by Dr. Glenn A. Fry and Dr. Arthur M. Culler, co-directors of the Institute.

A total of 2,125 refractionists were polled; 763 replies were received and of these 556 were usable. Answers which could not be tabulated were from areas in which television sets were too scarce and television reception too poor to permit anything more than a report of these facts. A few respondents felt the survey premature.

Most refractionists are finding that some of their patients suffer from eyestrain from television. But answers to the questionnaire indicated "there is no widespread belief among refractionists that television

is contributing to changes in the static refraction of the eye, the status of muscle balance, or to the development of such disorders as glaucoma and cataract, or to any serious impairment of the function and structure of the eye."

The tabulated replies showed that 3.41 per cent of new patients attribute their visual problems to television. The professional eyecare men believe, however, that some of these visits result from a sort of hysteria about the effect of television on the eyes, and failure on the part of new viewers to establish proper viewing habits.

The survey showed that persons consulting refractionists about television viewing difficulties are principally of two types: persons over 60 (wearers of multi-focal lenses in most cases), and viewers suffering from eyestrain.

The results imply that the older person visits his eyecare specialist not because of symptoms of eyestrain, but because he wants a clearer image. To help these people see television more comfortably, the refractionists are recommending several methods, the most widely used being the addition of a plus lens over and above the ordinary distance prescription.

The ophthalmologists and optometrists indicated that it is difficult to determine whether eyestrain is a direct result of television viewing. In their opinion, it has made people on the borderline of needing eyecare aware for the first time of their susceptibility to eyestrain.

Temporary blurring, night blindness and the occurrence of after images were listed by the refractionists as the chief complaints of their television viewing patients. The institute feels that insufficient evidence is available at this time to enable any conclusions to be drawn from these statements.

The Institute For Research In Vision asked the refractionists whether they were prescribing special lenses to be used solely for television viewing and whether patients came to them expecting to have special lenses prescribed. The results indicate that an average of 30 per cent of those answering this part of the questionnaire find it necessary, in certain cases, to prescribe a pair of lenses which would not be prescribed for general use.

The Institute believes that its survey is among the first to provide authoritative and accurate information based on the experiences of professional eyecare men with television-viewing patients. It provides information which will prove helpful to the general public as well as the refractionist. However, it emphasized the need for additional specific researches which must be undertaken before anyone will have full

knowledge of television's impact on eyesight.

The Institute mailed its questionnaire to 2,125 refractionists in a 9-state area serviced by 37 television stations. The cost of the project was underwritten by the White-Haines Optical Company, Columbus, Ohio.

N. S. P. B. CAMPAIGNS FOR BETTER SIGHT PROTECTION

A nationwide campaign to focus public attention on protection of eyesight was undertaken in September by the National Society for the Prevention of Blindness. Through every possible medium, the Society emphasized that more than half our annual toll of blindness could be prevented through public cooperation. The educational campaign was conducted by Dr. Franklin M. Foote, Executive Director of the Society.

MURROUGHS REPORTS ON STRABISMUS PROJECT

Results of a year's research on strabismus, carried on by the Chicago Strabismus Research project under the direction of Dr. Thaddeus Murroughs, are now available. The project was started in September, 1949; the research was conducted at the Chicago College of Optometry. Lack of space unfortunately prohibits the Journal from publishing the entire report, but the following excerpt briefly outlines the thinking of those who worked on the project. Speaking of orthoptics and strabismus with anomalous projection, Dr. Murroughs says:

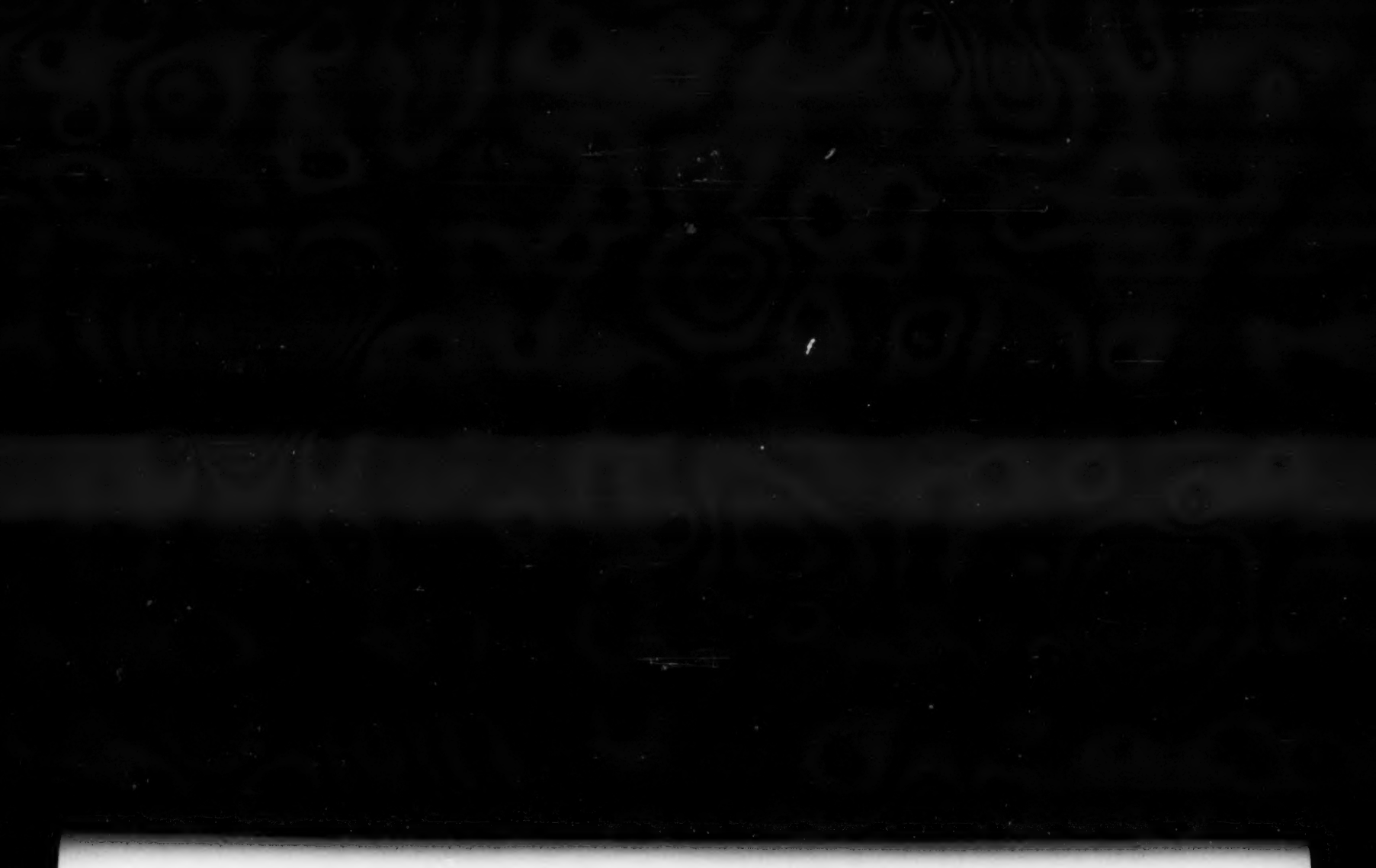
"Even the most skillful application of all means at one's disposal with all factors in one's favor leads to a permanent cure in only a relatively small number of cases. It would appear that the most promising approach would be an operative correction of the angle of squint with intensive pre- and post-operative orthoptics. This indicates the necessity of understanding and further investigating methods by which anomalous projection can be eliminated.

"Why should the idea of surgery, intelligently applied, be discarded?

"We have not found a single case in the literature which showed anomalous projection on every test and which was rehabilitated orthoptically. List the four top optometric names in the field of strabismus in the United States. Why do three of these four people routinely have operations performed on a relatively high percentage of their strabismic patients? Because they have learned through experience that the sensorial relationship of visual and postural components must be changed.

"Surgery is more dramatic, drastic and effective than routine orthoptics in these cases—but it is not the answer either. Leaders in the field of ophthalmology admit this freely.

"There is only one answer—prolonged, constant programs of research carried on at all levels, basic, clinical, practical and applied: research in the fields of physiological optics, psychology, behavior, adaptation, surgery, orthoptics, and refraction: studies in space perception, projection, localization, aniseikonia, sensory, motor and cortical levels of activity and their relationships."

NEWS BRIEFS

Dr. James L. Sears, ophthalmologist, has joined the faculty of the School of Optometry, Pacific University. He is a graduate of the University of Oregon, and has practiced ophthalmology and otolaryngology for 19 years. . . . Chicago College of Optometry conferred the O.D. degree on 96 candidates at their September commencement exercises; Southern College of Optometry on 51 students. It was the fourth commencement at Chicago College, and the largest graduating class to date. . . . Dr. E. D. Tillyer, 68, is celebrating his 35th year with the American Optical Company and his 150th invention. The former Government scientist and inventor of the Tillyer lens, is renowned for his work in the field of optics, motion pictures, radio and television. His latest development is a haze-penetrating and glare-absorbing sun glass lens used by American pilots in the Korean war area. . . . Edison Electric Institute has launched an extensive planned lighting program for office, home, store, school and factory markets. . . . Bausch & Lomb reports the government is buying from them a record quantity of eye testing equipment for the Air Force. . . . Children's vision will be the discussion topic of a Mid-Century White House Conference in December. Assisting with program arrangements are Drs. John B. O'Shea and Marguerite T. Eberl of the A. O. A. . . . Dr. Harold Bookstaber, president, New Jersey Optometric Association, announces the appointment of a new committee for emergency civilian visual care: Dr. Norman E. Opas, Cliffside Park; Dr. Leon S. Deutsch, Jersey City; Dr. Ernest E. Linke, Orange; Dr. Samuel Lonsk, Linden; Dr. M. P. Costantini, Trenton; Dr. Jerome Bartok, Penns Grove; Dr. H. H. Auerbach, Millville; Dr. Salvie J. Fonte, Atlantic City; Dr. Irwin H. Treiser, Sussex; Dr. Leonard D. Friedman, Rahway. . . . The New Middle Atlantic Educational Congress gets under way October 29, in Pittsburgh, with a star-studded lecture roster. Dr. Arnold Gesell, child development specialist, will appear before this group for the first time, as will Dr. Harold Haynes, Pacific University School of Optometry. Other speakers will be Dr. Darrell Boyd Harmon and Dr. A. M. Skeffington.